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**Acridoidea
of Southern Alberta,
Saskatchewan, and Manitoba
(Orthoptera)**

by

ARTHUR R. BROOKS

Entomology Section
Canada Department of Agriculture Research Laboratory
Saskatoon, Saskatchewan

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Acridoidea of Southern Alberta, Saskatchewan, and Manitoba (Orthoptera)¹

By A. R. BROOKS²

Entomology Section
Canada Department of Agriculture Research Laboratory
Saskatoon, Saskatchewan

INTRODUCTION

This is a report of the systematics of the orthopterous families Acrididae and Tetrigidae of Alberta, Saskatchewan, and Manitoba between the forty-ninth and fifty-fifth parallels of north latitude. Comments are made on a number of allied American species of special interest to workers in the area.

Four species of Tetrigidae, representing two subfamilies, and 87 species or subspecies of Acrididae, representing three subfamilies, have been collected in the area. This is less than one-sixth of the total described from North America.

ACKNOWLEDGMENTS

I am much indebted to Dr. A. B. Gurney, Entomology Research Branch, United States Department of Agriculture, Washington, D.C., who corrected the taxonomy of the original manuscript. He also furnished the chart on classification and numbers of North American species. Dr. R. T. Coupland, Professor of Plant Ecology, University of Saskatchewan, Saskatoon, examined the ecological map of the area and added materially to it. Mr. R. Pickford, Entomology Section, Saskatoon, who is studying the feeding habits of prairie grasshoppers, furnished many of the notes on the food of the species.

In addition to material collected by my colleague L. A. Kelton, now of the Entomology Division, Ottawa, and myself for this report, specimens were obtained from the University of Alberta, Edmonton (B. Hocking); the University of Saskatchewan, Saskatoon (J. G. Rempel); and the University of Manitoba, Winnipeg (A. G. Robinson); from the Entomology laboratories at Kamloops, B.C. (R. H. Handford), and Lethbridge, Alta. (C. W. Farstad), Saskatoon, Sask. (H. McDonald), and Brandon, Man. (R. D. Bird); and from the Canadian National Collection, Ottawa, Ont. (G. P. Holland).

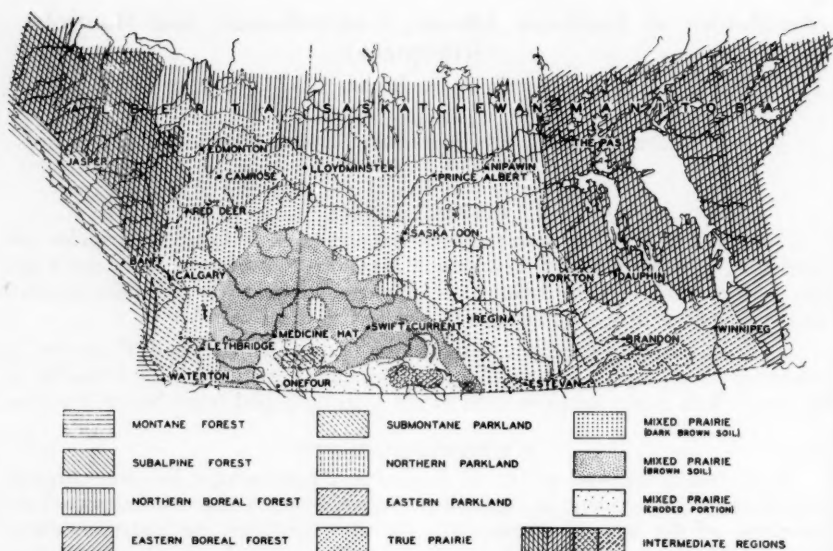
REVIEW OF LITERATURE

The Acridoidea has not been treated in its entirety in a single work except in the catalogues of Scudder (1901) and Kirby (1910). The literature at present is in an unsatisfactory and scattered state. The keys to genera and species, as well as notes on synonymy, distribution, and habits of North America species, are contained for the most part in a number of state or regional manuals and lists. The most important of the manuals for the prairie region are those of Blatchley (1920) for the eastern portion of the area, and of Hebard (1932, 1925, 1936, 1928) for Minnesota, South Dakota, North Dakota, and Montana, respectively. Canadian lists of species include those of Buckell (1922) for British Columbia, of Hebard (1930) and White and Rock (1945) for Alberta, of Walker (1910) for the Western Provinces, and Walker (1902) for Ontario.

Food habits of prairie grasshoppers have been studied by Criddle (1933), Isely (1938, 1944), Pfadt (1949), Prescott (1951), Anderson and Wright (1952), Newton and Esselbaugh (1952), and Pickford (unpublished). These reports

¹Contribution No. 3693, Entomology Division, Science Service, Department of Agriculture, Ottawa, Canada.

²Entomologist.



Map 1. Bio-ecological regions of southern Alberta, Saskatchewan, and Manitoba.

indicate that grasshoppers are rarely specific in food except in a limited area, and that the species vary considerably in preference from one area to another. Grass-feeding species rarely become pests on grain.

ECOLOGICAL ASSOCIATIONS AND DISTRIBUTIONS OF SPECIES

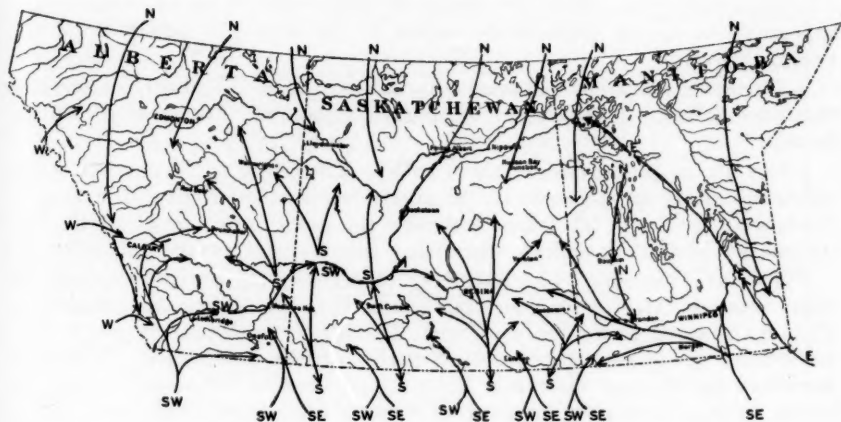
BIO-ECOLOGICAL REGIONS OF SOUTHERN ALBERTA, SASKATCHEWAN, AND MANITOBA

Several attempts have been made to define biogeographical areas, such as life zones, vegetation belts, and phytogeographic regions in the Prairie Provinces. Nearly all the comprehensive accounts for this area are based on botanical observations (Halliday, 1937; Coupland, 1950; Coupland and Brayshaw, 1953; and Moss, 1955) or on soil zones (Odynsky, 1945; Mitchel *et al.*, 1944, 1950; and Ellis, 1938). Clements and Shelford (1939) outlined the general aspects of both animal and plant associations of the North American grasslands, Bird (1930) determined some of the more specific biotic communities in the aspen parklands, and Strickland (1938) proposed a number of small biotic areas in Alberta.

The general result has been one of considerable confusion in concepts and terminology. For our present purposes a modified form of the regions proposed by the above authors has been adopted (Map 1). The modifications are based chiefly on the distributions of the insect groups Acridoidea (95 species), Elateridae (135 species), and Hemiptera (550 species) of the area.

ECOLOGICAL ASSOCIATIONS AND DISTRIBUTIONS

"When two habitats adjoin each other (as for instance a meadow and a swamp or a steppe and a forest), there is between them a border-zone in which the elements of both associations come into a close contact, without being specially adapted to each other, as the members of a single association are. The significance of this zone is particularly great because of the natural tendency of each association to extend its limits, which results in acute competition in the



Map 2. Distributional tendencies of acridoid species in southern Alberta, Saskatchewan, and Manitoba. W, mountain species; SW, foothills or southwestern species; S, central prairie and parkland species; SE, eastern prairie species; N, northern forest species; E, eastern forest species.

border-zone. If, at the same time, the general conditions of the whole region undergo a gradual change into a direction favourable to the one of the two associations, the latter will steadily extend its area at the expense of the other" (Uvarov, 1928, p. 28).

The more important process contributing to the succession of one association over another is very slow, going on steadily in connection with gradual changes to natural habitats in geology and in climate, and with the changes made by man. The less important process, the periodic increase or decrease in population densities, also aids in extending the geographical distribution of the species. The isolated colonies of some species (the Lumsden colony of *Trimerotropis pistrinaria* Sauss. or the Pike Lake colony of *Melanoplus buroni* Blatch., for example) appear to be remnants of a more general distribution during periods favourable to population increase.

The members of an ecological succession tend to extend or withdraw their boundaries as a single unit, with varying degrees of success for each member. Each association appears to have, or to have had in the past, a centre of distribution from which it has spread as far as climatic factors or competition with other associations has permitted.

If the individual static distributions of grasshopper subspecies be combined with their differences in densities throughout their ranges, an approximation of the extent and direction of the various distributional tendencies is obtained (Map 2). The deep river valleys of the North and South Saskatchewan, the Qu'Appelle, the Assiniboine, the Souris, and tributaries of the Missouri allow species to penetrate far into territory normally foreign to them, and large sand masses along these valleys allow these extended populations to become established.

ASSOCIATIONS OF ACRIDOID SPECIES IN THE PRAIRIE PROVINCES

Six associations of species or subspecies are found in the Prairie Provinces, the subspecies being considered the basic taxonomic unit in determining ecological association:—

Mountain Species (W).—The centre of distribution for the following species appears to be in the mountainous region to the west and southwest of the Prairie Provinces:

Asemoplus montanus (Bruner); *Buckellacris nuda* (Walker); *Melanoplus montanus* (Thomas); *Melanoplus oregonensis* (Thomas); *Trimerotropis suffusa* Scudder.

Foothills or Southwestern Species (SW).—The centre of distribution of the following species appears to be on the eastern slopes of the Rocky Mountains in the United States. In the Prairie Provinces the species often penetrate far into the interior along river valleys, where their distributions become discontinuous:

Aeoloplus turnbulli (Thomas); *Hypochlora alba* (Dodge); *Melanoplus alpinus* Scudder; *Melanoplus bowditchi canus* Hebard; *Melanoplus occidentalis* (Thomas); *Acrolophus hirtipes* (Say); *Cordillacris crenulata* (Bruner); *Drepanopterna femoratum* (Scudder); *Eritettix simplex tricarinatus* (Thomas); *Mermiria maculipennis macclungi* Rehn; *Opeia obscura* (Thomas); *Circotettix rabula* Rehn; *Derotmema haydenii* (Thomas); *Hadrotettix trifasciatus* (Say); *Spharagemon equale* (Say); *Trimerotropis gracilis sordida* Walker; *Trimerotropis pistrinaria* Saussure; *Trimerotropis sparsa* McNeill; *Trimerotropis latifasciata* Scudder.

Central Prairie and Parkland Species (S).—A large number of species and subspecies of the north-central prairie region of North America have a very limited distribution southward. The centre of distribution of the following species appears to be in central or north-central United States.

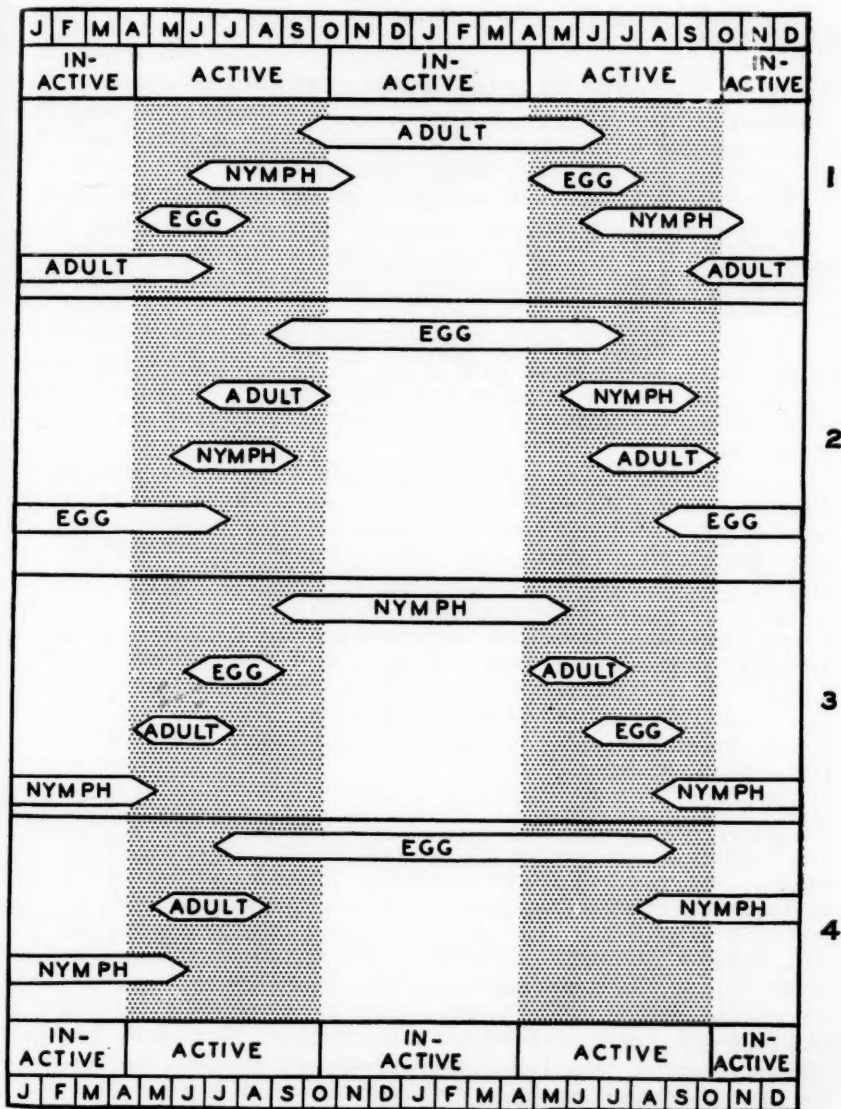
Hesperotettix viridis pratensis Scudder; *Melanoplus bilituratus* (Walker); *Melanoplus confusus* Scudder; *Melanoplus flavidus* Scudder; *Melanoplus gladstoni* Scudder; *Melanoplus infantilis* Scudder; *Melanoplus packardii* Scudder; *Phoetaliotes nebrascensis* (Thomas); *Aeropedellus clavatus* (Thomas); *Ageneotettix deorum* (Scudder); *Amphitornus coloradus* (Thomas); *Aulocara elliotti* (Thomas); *Bruneria brunnea* (Thomas); *Chorthippus longicornis* (Latreille); *Cordillacris occipitalis cinerea* (Bruner); *Psoloessa delicatula* (Scudder); *Aerochoreutes carlinianus* (Thomas); *Arphia conspersa* Scudder; *Arphia pseudonietana* (Thomas); *Cammula pellucida* (Scudder); *Cratypedes neglectus* (Thomas); *Dissosteira carolina* (Linnaeus); *Encoptolophus sordidus costalis* (Scudder); *Metator pardalinus* (Saussure); *Spharagemon collare* (Scudder); *Trachyrhachys kiowa* (Thomas); *Trimerotropis campestris* McNeill; *Trimerotropis pallidipennis salina* McNeill; *Xanthippus corallipes latifasciatus* (Scudder); *Tetrix ornata* (Say).

Eastern Prairie Species (SE).—The centre of distribution of the following species appears to be in east-central North America. Several of the species have wide distributions in the Prairie Provinces, but become increasingly scarce and more confined to special habitats in Saskatchewan and Alberta:

Melanoplus angustipennis (Dodge); *Melanoplus bivittatus* (Say); *Melanoplus dawsoni* (Scudder); *Melanoplus femur-rubrum* (DeGeer); *Melanoplus foedus* Scudder; *Melanoplus keeleri luridus* (Dodge); *Schistocerca lineata* Scudder; *Orphulella speciosa* (Scudder); *Orphulella pelidna* (Burmeister); *Pseudopomala brachyptera* (Scudder); *Chorthippa viridifasciata* (DeGeer); *Spharagemon bolli* Scudder.

Northern Forest Species (N).—The species of the northern forest often extend far into the parklands, and into the eastern and western forests. The following species belong to the northern forest association:

Melanoplus bilituratus atlantis (Riley); *Melanoplus borealis* (Fieber); *Melano-*



TYPES OF SEASONAL HISTORIES OF PRAIRIE GRASSHOPPERS

plus bruneri Scudder; *Melanoplus fasciatus* (Walker); *Melanoplus buroni* Blatchley; *Melanoplus packardii* subsp.; *Chloetis conspersa* (Harris); *Neopodismopsis abdominalis* (Thomas); *Stethophyma gracile* (Scudder); *Stethophyma lineatum* (Scudder); *Circotettix verrucullatus* (Kirby); *Pardalophora apiculata* (Harris); *Xanthippus corallipes montanus* (Thomas); *Tetrix subulata* (Linnaeus).

Eastern Forest Species (E).—The centre of distribution of the following species appears to be in the forest region of Eastern Canada and northeastern United States:

Melanoplus foedus stonei Rehn; *Melanoplus islandicus* Blatchley; *Tettigidea lateralis* (Say).

LIFE-CYCLES OF PRAIRIE ACRIDOIDEA

The activity of prairie grasshoppers in Canada is limited by the long, cold winters (October to May) and the short summers. No species has more than one generation each year, and a number require two years for one cycle.

Four types of life-cycles are exhibited by the grasshoppers in this region.

Type 1: Found only in the Tetrigidae. Inactive or hibernating period spent as an adult or last-stage nymph. Eggs laid in May and June. Nymphs appearing in June and generally maturing by late August and September. Life-cycle of one year.

Type 2: Found in all Cyrtacanthacridinae and in most Acridinae and Oedipodinae. Inactive period spent in the egg stage. Eggs hatching during May and June. Nymphs maturing from early June until late August. Adults active during the later half of July until September or October. Life-cycle of one year.

Type 3: Found in the acridines *Eritettix simplex tricarinatus* and *Psoloessa delicatula delicatula* and the oedipodines *Chortophaga viridifasciata* and *Arphia conspersa*. Inactive period spent as a nymph. Nymphs maturing in May and adults active until late June. Eggs hatching during June and July, and the partially grown nymphs hibernating in September. Life-cycle of one year.

Type 4: Found in the oedipodines *Pardalophora apiculata*, *Xanthippus corallipes latifasciatus*, and *Arphia conspersa* and possibly in the acridine *Psoloessa delicatula*. Inactive periods spent in the egg stage (first year) and as a partially grown nymph (second year). Adults active in May, June, and July, depositing eggs which remain in the soil until the following July or August. Partially grown nymphs hibernating in September and maturing the following May. Life-cycle two years.

Pickford (1953) has shown that in addition to the long egg diapause in this group, the eggs hatch two months later in the season than those of Type 2 grasshopper. He also suggests that the nymphs may undergo diapause. Diapause in the nymph may account for adults sometimes encountered in the field in August and September.

CLASSIFICATION

SPECIFIC AND INTRASPECIFIC CATEGORIES IN ACRIDOIDEA

Grasshoppers belong to a very plastic group, particularly sensitive to ecological and environmental differences and changes. Some of the ecological differences, such as those found between forest and grassland, have produced comparatively stable subspecies. Some environmental influences, such as found during prolonged wet or dry periods, produce non-stable, periodic forms within populations. There are, therefore, larger aggregations of populations (species), more or less divided into smaller aggregations by comparatively stable ecological influences (subspecies), these in turn being periodically changed by less stable climatic factors (forms). Superimposed upon each of these is the variable genetic make-up of the individual (variants).

Formerly each of the populations, the climatically induced forms, the single conspicuous variants, and the aberrations were named by taxonomists. This practice, however, obscures the species (as well as being contrary to the Inter-

national Rules of Nomenclature), as has been pointed out by Mayr, Linsley, and Usinger (1953).

The specific and infraspecific categories encountered in Acridoidea may be determined as follows:

- A. Groups of interbreeding or potentially interbreeding populations; composite, heterogeneous categories; intermediates between separate groups absent or, if present, less than 10 per cent of the total, or confined to a comparative narrow zone of contact between groups; namable taxonomic categories.
- B. Groups of actually or potentially interbreeding populations that are reproductively isolated from other such groups; usually separated on the basis of morphology, physiology, reproductive isolation, and ecology; often occupying several major ecological or geographical regions; intermediates virtually absent in the zone of contact species
- BB. Groups of local, interbreeding populations, geographically defined, that differ taxonomically from other such subdivisions of the same status; usually separated on the basis of quantitative (colour, size) and ecological differences; occupying a single ecological or geographical area; intermediates usually present in the zones of contact; geographical or ecological races subspecies
- AA. Not groups of populations or composite categories; individuals, or single, local populations; intermediates between samples absent or, if present, more than 10 per cent of the total and not usually confined to zones between populations; not namable taxonomic categories.
- B. Intermediates between samples absent or nearly so (except for continuous genetic variation); variation inherited.
- C. Local populations of comparatively small, ecological areas; differing slightly in gene frequencies and mean values of quantitative characters (as the eastern population of *Crotettix rabula*) population
- CC. Individuals with continuous or discontinuous variation in a single interbreeding population due to genetic polymorphism, as for example Mendelian variations (colour variants of *Chortophaga viridifasciata*, or morphological variants in *Melanoplus dawsoni*) variant
- BB. Intermediates between samples numerous; variation not inherited.
- C. Variation due to different degrees of mutual stimulation between individuals composing populations of different densities, leading to the appearance of distinct physical types that typically differ also in their physiology and behaviour (as in *Locusta migratoria* (L.)) phase
- CC. Variation apparently due to climatic factors, especially those of temperature and humidity, leading to the appearance of a physical type that may also differ in behaviour form

The phase theory of periodicity of locusts (Uvarov, 1921, 1928; Key, 1951), originally proposed to explain the activity and swarming of *Locusta migratoria*, has been applied in North America to *Melanoplus spretus* (Walsh) (the migratory phase) and *Melanoplus mexicanus* (Sauss.) (the non-migratory phase). Recent work (Gurney and Brooks, in preparation) has shown that the two species are distinct and not phases of one species as generally supposed. No Canadian species develops true phases (Putman, 1954).

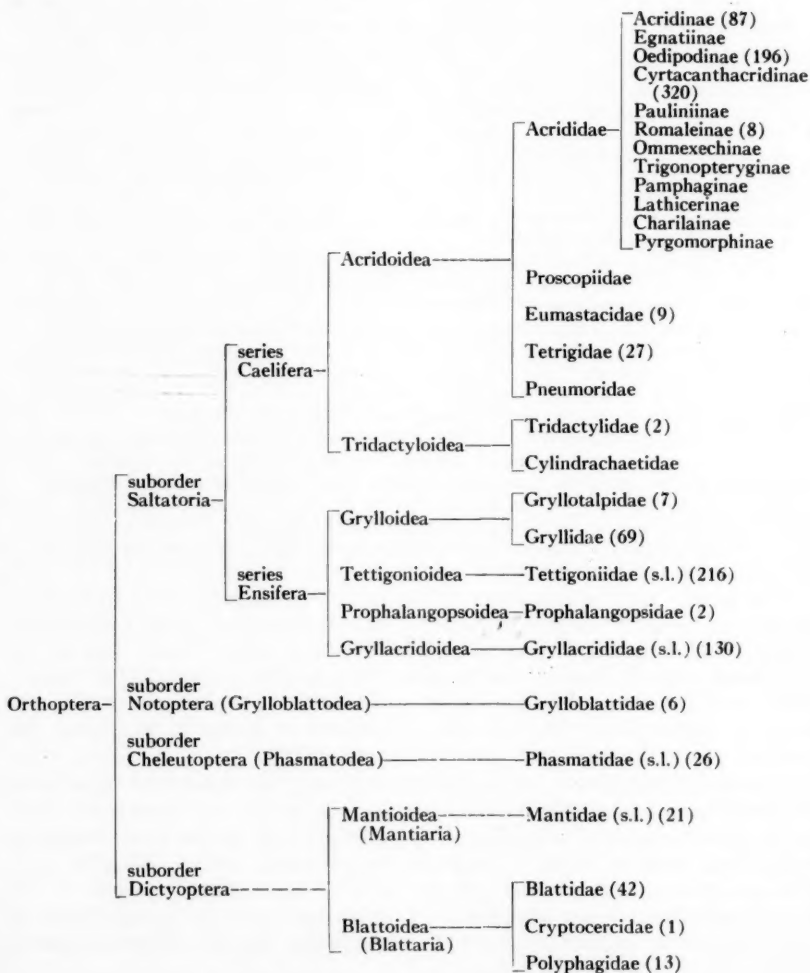
Criddle (1933), Faure (1933), and Brett (1947), working with populations of *Melanoplus bilituratus* (Walker) (*M. mexicanus* auctt.), produced much variation in colour, size, and wing length by manipulating temperature, humidity, density, and food in cages. The variation produced under controlled conditions is similar to that in nature when observed over a sufficient period of time. Intermediates between the climatically induced form and the parent form are usually numerous, and the border-zone between the two is not usually clearly defined.

Climatically induced forms may be relatively stable from year to year or periodic; they occur more often in some geographical areas than in others. The differences between the form and the parent may be expressed by qualitative

morphological change (*Aerochoreutes carlinianus*, *Xanthippus corallipes latefasciatus*), or by quantitative changes in colour, size, and length of wing (*Melanoplus bilituratus*, *Melanoplus borealis*).

CLASSIFICATION AND NUMBERS OF NORTH AMERICAN ORTHOPTERA

It is not within the scope of this paper to discuss the classifications or relationships of North American Orthoptera. For our present purposes the classification used in the United States National Museum, Washington, has been adopted (see classification chart). The numbers in parentheses after the names are the approximate numbers of described species and subspecies in America north of Mexico. Subfamilies are shown only in Acrididae.



Classification of North American Orthoptera

Key to Families and Subfamilies

- A. Pronotum elongate, covering all or nearly all of the hind wings and abdomen; tegmina reduced to pads; prosternum specialized as a "chin piece"; arolium absent; fore- and mid-tarsi with two segments only, the hind tarsus with three segments; small species, up to 16 mm. long Tettigidae
- B. Antenna with 20-22 segments; front margin of pronotum obtusely produced forward between the eyes (*Tettigidea*) Batrachidinae
- BB. Antenna with 12-14 segments; front margin of pronotum nearly straight (*Tetrix*) Tetriginae
- AA. Pronotum short, not extending over the abdomen; tegmina present or absent; prosternum small, not specialized as a "chin-piece"; each tarsus with three segments; arolium present; larger species, usually more than 16 mm. long Acrididae
- B. Prosternum with a prominent, erect, conical spine or tubercle between the front legs; stridulating pegs absent, both the wing veins and the ridge on the inside of the hind femur bare; pronotum short and obtusely rounded behind; median carina of pronotum low or absent; face usually not slanting; hind wings, when present, clear and not banded Cyrtacanthacridinae
- BB. Prosternum without a prominent, conical spine between the front legs; stridulating pegs present either on the ridge of the inside of the hind femur or on the wing veins.
 - C. Stridulating apparatus of male in the form of a row of small pegs on a ridge on the inside of the hind femur, the wing veins bare; posterior margin of pronotum convex to nearly straight behind (acute in *Acrolophirus*); median carina of pronotum, if present, low; face usually slanting; hind wings colourless and without bands (except *Acrolophirus*) Acridinae
 - CC. Stridulating apparatus of male in the form of rows of small pegs on the wing veins, the ridge on the inside of the hind femur bare; posterior margin of pronotum produced as a triangular projection behind (comparatively obtuse in *Stethophyma*, *Cammula*, and *Encoptolophus*); median carina of pronotum usually high and sharp; face not usually slanting; hind wings coloured or banded Oedipodinae

FAMILY ACRIDIDAE

No entirely satisfactory division of the family into subfamilies has been accomplished for the world fauna. The problem is centred in the midst of the acridine-oedipodine complex, where a number of genera have contradictory combinations of structures. An outstanding recent attempt by Roberts (1951) to find conclusive characters in the male aedeagus was only partially successful. Uvarov's (1943) division, using the type of stridulating apparatus of the male, appears satisfactory for the study area.

The oldest name given to the group is *Acrydiana*, applied by Latreille in 1802. *Acrididae* is therefore preferable over *Locustidae*, the name formerly applied to this family.

SUBFAMILY CYRTACANTHACRIDINAE

Face almost perpendicular; antenna threadlike, vertex usually convex, the lateral foveolae vague or absent; pronotum short, never tuberculate or wrinkled, the hind margin obtusely rounded; median carina of pronotum low and of equal height throughout or absent; lateral pronotal carina obsolete or rounded; tegmina and wings variable in length, sometimes absent or greatly reduced; hind wing transparent, without coloured bands; stridulating pegs absent, the wing veins and ridge on inner surface of the hind femur bare; species usually dull and olivaceous-brown, a few bright green or fawn.

The eight genera found in the study area may be divided into two main groups as follows:—

Group 1. Lobes of mesosternum longer than broad, their inner margins straight; side margins of pronotum rounded; size larger; subgenital plate of male with a distinct U-shaped notch at the apex. Genus *Schistocerca*.

Group 2. Lobes of mesosternum transverse, at least as wide as long, their inner margins usually rounded; side margins of pronotum usually angulate; size smaller; subgenital plate of male without a distinct U-shaped notch at apex. Genera *Hypochlora*, *Aeoloplus*, *Hesperotettix*, *Asemoplus*, *Buckellacris*, *Phoetaliotes*, and *Melanoplus*.

Key to Species

1. Species 35-60 mm. long, yellowish-brown with well-marked, median, dorsal, yellow stripe; extreme south and southwest *Schistocerca lineata* Scudder
Smaller species, greenish to dark brown 2
2. Species chiefly light green with variable markings, occasionally pale grey 3
Species brownish, brownish-grey, or black 5
3. Median carina present as a ridge for entire length of pronotum, cut only by principal sulcus; prosternal tubercle short and sharp (Fig. 29); tegmina short (rarely long in females); small, slender, greenish-yellow or grey species; extreme south and southwest *Hypochlora alba* (Dodge)
Median carina absent or present as a ridge only behind principal sulcus; prosternal tubercle larger, or rounded at apex; tegmina reaching at least to near end of abdomen 4
4. Femora and fore- and mid-tibiae curved, short, and squat; median carina of pronotum present as a ridge behind principal sulcus; greenish or greenish-brown species with variable amounts of darker, greenish-brown markings, and conspicuous bands across outer face of hind femora; alkaline plains of south and southwest *Aeoloplus turnbulli turnbulli* (Thomas)
Femora and fore- and mid-tibiae not noticeably curved, not short or squat; median carina of pronotum absent, represented only by a broad white line; bright-green species with pink suffusions on legs and thorax; hind femora not cross-banded; widespread in south *Hesperotettix viridis pratensis* Scudder
5. Tegmina absent; male with two broad, yellow, longitudinal lines on dorsal surface from eyes to genitalia, these lacking in female except in front; mountain species *Buckellacris nuda nuda* (Walker)
Tegmina present, long or short 6
6. Tegmina separated from each other at their bases by a distance greater than their length; tegmina very small linear pads that are lateral in position; mountain species *Asemoplus montanus* (Bruner)
Tegmina not separated at their bases by more than half their length 7
7. Head disproportionately large in relation to thorax, being both high and wide; face noticeably slanted, especially below; pronotum slender, the sides appearing to converge posteriorly; tegmina usually reduced; slender brownish species with bluish hind tibia; grasslands of south *Phoetaliotes nebrascensis* (Thomas)
Head not enlarged; face less oblique; sides of pronotum divergent behind 8
8. Tegmina short, extending at most to fourth abdominal segment 9
Tegmina extending beyond sixth abdominal segment 13
9. Hind tibia buff to blue; tegmina extending to second abdominal segment; mountain and foothills *Melanoplus oregonensis* (Thomas)
Hind tibia red or pink 10
10. Abdominal tergites banded, the anterior half of each black, the posterior half yellow; tegmina pointed at apices; prosternal tubercle blunt (Fig. 29); general distribution *Melanoplus dawsoni* (Scudder)
Abdominal tergites not banded; tegmina rounded at apices; prosternal tubercle pointed 11
11. Tegmina extending to third or fourth abdominal segment, tapered to rounded apices; hind femora reddish below, and rather conspicuously cross-banded on outer surface; forest species *Melanoplus buroni* Blatchley
Tegmina small, rounded or pointed pads extending to second abdominal segment; hind femora yellow or mottled below 12
12. Abdomen with broad, median, longitudinal, pale line; hind femora not noticeably cross-banded on outer surfaces; pine forest of eastern Manitoba *Melanoplus islandicus* Blatchley

- Abdomen without pale dorsal line, or this narrow and spotted; hind femur conspicuously cross-banded on outer surface; mountains and foothills.....
Melanoplus montanus (Thomas)
13. Abdominal tergites conspicuously banded, the anterior half of each black, the posterior half yellow; prosternal tubercle blunt (Fig. 29); general distribution.....
Melanoplus dawsoni (Scudder)
- Abdominal tergites not conspicuously banded; prosternal tubercle more pointed..... 14
14. Large, dark olive-green species with a pair of narrow, yellow, dorsal lines reaching from eyes to tips of tegmina; hind femur with narrow, longitudinal, black stripes on outer surface and on upper, inner edge of flange; general distribution.....
Melanoplus bivittatus (Say)
- Dorsal stripes present on head and thorax only or absent; hind femora showing cross-banding, at least on dorsal surface..... 15
15. Hind femora conspicuously reddish beneath and inside..... 16
- Hind femora greenish to yellow beneath, or with a reddish streak on outer surface of ventral flange..... 19
16. Hind tibiae dark blue or purple; southwestern.....
Melanoplus occidentalis occidentalis (Thomas)
- Hind tibiae reddish..... 17
17. Hind femur banded on outer surface..... 18
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Genus *Aeoloplus* Scudder

Aeoloplus Scudder, 1897, Proc. Amer. Acad. Arts and Sci. 32: 199.

Genotype: *Aeoloplus bruneri* Caudell.

Greenish species with variable greenish-brown markings. Tibiae and femora curved, short, and squat; median carina of pronotum present as a ridge only behind principal sulcus.

The species are found on the alkaline plains of the southern United States, only one extending into the Prairie Provinces.

Aeoloplus turnbulli turnbulli (Thomas)

Caloptenus turnbulli Thomas, 1872, Ann. Rept. U.S. Geol. Surv. Terr. 5: 452.

Two forms of this subspecies have been collected in the Prairie Provinces.

These may be separated as follows:

- Tegmina not extending to apices of hind femora; brown markings reduced or absent the specimens greenish-yellow with green or olive-green markings; length 14-17 mm. minor form
- Tegmina extending almost to apices of hind femora; brownish or brownish-green markings usually extensive; length 16-22 mm. major form

The minor form of the subspecies has been collected only at a few localities in southeastern Alberta (Onefour, Manyberries) and southwestern Saskatchewan (Senate, Consul). In the same area the major form also occurs but intermediates between the two form the greatest part of the population.

The subspecies feeds on chenopodiaceous plants, especially *Atriplex* spp.

Distribution.—Two subspecies of *turnbulli* are recognized at present. *A. turnbulli bruneri* Caudell occurs from Wyoming, North Dakota, and South Dakota to Kansas, Nebraska, Texas, Colorado, and New Mexico. *A. turnbulli turnbulli* (Thomas) occurs from Alberta and Saskatchewan, southward through Wyoming and along the mountains to New Mexico, and eastward to the Dakotas and Nebraska.

In the study area *turnbulli* occurs in dry alkaline localities throughout the eroded portion of the mixed prairie, extending as far northward as Drumheller, Alta., and Elbow, Sask. (Map 3).

Genus *Asemoplus* Scudder

Asemoplus Scudder, 1897, Proc. Amer. Acad. Arts and Sci. 32: 203.

Genotype: *Bradynotes montanus* Bruner.

The genus is very similar to *Melanoplus*. The single species found in the study area may easily be recognized by the greatly reduced tegmina and wings.

Asemoplus montanus (Bruner)

Bradynotes montanus Bruner, 1885, Can. Ent. 17: 16.

Tegmina present as short linear pads; tegminal pads separated from each other at their bases by a distance greater than their length; male and female with one central yellow stripe on dorsal surface of abdomen. Male subgenital plate

pointed to rounded at apex; furculae absent. Female cercus short and triangular. Length 15-18 mm.

Distribution.—Montana, British Columbia, and southwestern Alberta.

In the study area *montanus* has been collected only in the mountains of western Alberta at Waterton, and Crowsnest Pass.

Genus *Buckellacris* Rehn and Rehn

Buckellacris Rehn and Rehn, 1945, Trans. Amer. Ent. Soc. 71: 1.

Genotype: *Bradynotes chilcotinae* Hebard

Buckellacris is readily separated from *Asemoplus* Scudder by the complete lack of tegmina and wings, and by the less compressed form. Only one species occurs in the Prairie Provinces.

Buckellacris nuda nuda (Walker)

Asemoplus nudus Walker, 1898, Can. Ent. 30: 197.

Male cercus broad at base, tapered to a rounded point, both edges concave; furculae a pair of well developed trigonal plates; supra-anal plate with lateral margins lacking distinct median shoulder. Female cercus long and conical, the margins concave, valves of ovipositor short and stout, the dorsal angle obtuse. General colour greenish-black, the male with a pair of yellow dorsal lines reaching from eye to genitalia, these not as obvious in the female; hind femur pale, without crossbands; hind tibia greenish-yellow. Length 15-24 mm.

The history of the name *nuda* is much involved and the species has been reported from Alberta as *Asemoplus somesi* Hebard (a synonym) and as *Asemoplus hispida* (Bruner) (a distinct species).

Distribution.—Two subspecies of *nuda* are recognized at present. *B. nuda nuda* (Walker) occurs in southwestern Alberta, British Columbia, Idaho, Washington, and Montana. *B. nuda relicta* Rehn and Rehn is known from Idaho.

In the study area *nuda* has been collected in the mountains near or above timberline from localities near Waterton and Banff.

Genus *Hesperotettix* Scudder

Hesperotettix Scudder, 1876, Bull. U.S. Geol. Geogr. Surv. Terr. 2: 262.

Genotype: *Caloptenus viridis* Thomas

Only one species has been collected in the Prairie Provinces.

Hesperotettix viridis pratensis Scudder

Hesperotettix pratensis Scudder, 1897, Proc. U.S. Natl. Mus. 20: 64.

Pronotum green with pale yellow mid-dorsal stripe, or with considerable pink suffusion on each side of stripe; tegmina green with short, narrow, and ill-defined pinkish stripes near bases; fore- and mid-femora pink; hind femur green with pink preapical band. Tegmina usually not reaching apices of hind femora, but occasionally extending to or beyond apices. Length 18-27 mm.

The subspecies feeds on broad-leaved plants such as *Solidago* spp., *Helianthus* spp., *Gutierrezia* spp., *Grindelia* spp., or *Aster* spp.

Distribution.—Three subspecies of *viridis* are recognized at present. *H. viridis viridis* (Thomas) occurs in Nebraska, Oklahoma, Iowa, Texas, Colorado, Wyoming, Utah, and California. *H. viridis nevadensis* Morse is found in Nevada. *H. viridis pratensis* Scudder occurs from Manitoba to southern British Columbia and in Minnesota, Illinois, Iowa, Nebraska, Kansas, North and South Dakota, Wyoming, Montana, and Oklahoma.

In the study area *pratensis* occurs on the mixed and true prairies of the southern half of the area, from Drumheller and MacLeod, Alta. to Carman, Man. (Map 4).

Genus *Hypochlora* Brunner

Hypochlora Brunner, 1893, Ann. Mus. Stor. Nat. Geneva 33: 145.

Genotype: *Pezotettix alba* Dodge.

Only one species has been placed in this genus.

***Hypochlora alba* (Dodge)**

Pezotettix alba Dodge, 1876, Can. Ent. 8: 10.

Small, slender, greenish-yellow or greyish species with short, pointed tegmina (rarely long in females). Median carina present as a ridge for entire length of pronotum; prosternal tubercle short and sharp. Male subgenital plate with tubercle at apex; cercus slender except at base; furculae short and very slender. Length 15-20 mm.

The species feeds on *Artemisia* spp.

Distribution.—Western Minnesota, Iowa, eastern Kansas, Oklahoma, north-central Texas, Colorado, Montana, North Dakota, Manitoba, Saskatchewan, and Alberta.

In the study area *alba* has been collected only along the southern border of the mixed and true prairies from Onefour, Alta., to Carberry, Man. (Map 5).

Genus *Melanoplus* Stål

Melanoplus Stål, 1873, Recensio Orth. 1: 79.

Genotype: *Acrydium femur-rubrum* DeGeer.

A very large genus of North American species showing considerable diversity both in morphology and habitat.

Head moderately prominent but not enlarged; face almost vertical; median carina of pronotum nearly absent, never prominent; lateral carina of pronotum obsolete; prosternal tubercle or spine variable but always prominent; tegmina always present, but often abbreviate to about length of pronotum, either pointed or rounded at apices; tegmina not separated at bases by more than one-half of their greatest width; subgenital plate of male variable form, with no distinct apical tubercle, though not infrequently apically produced or subtuberculate.

The species have been grouped into a number of sections or series (Scudder, 1897), using characters of wing length, colour of hind tibia, shape of prosternal spine, and the general shape of the male and female genitalia. Previous groupings do not agree with groupings based on the aedeagus, and at present the exact relationship of the many species is unknown.

The male aedeagus contains excellent structural characters for the determination of species and of species-groups and is very easily observed by raising the membranous pallium. In some species groups, as *bilituratus-bruneri-borealis*, *foedus-packardii*, or *bowditchi-flavidus*, it is advisable to examine this structure.

No successful key to the females of the entire genus has been published. In this summary Handford's key (1946) to the species of Manitoba has been used as a basis.

***Melanoplus alpinus* Scudder**

Melanoplus alpinus Scudder, 1897, Proc. U. S. Natl. Mus. 20: 333.

Male cercus moderately large and long, with apical part divided into a dorsal, thumb-like portion and a long, slender, ventral portion, the ventral portion strongly curved (Fig. 11); supra-anal plate long, and triangular with central groove; furculae small; apex of subgenital plate truncate and dished-out behind. Dorsal angle of ovipositor about 120 degrees; notch of eighth sternite moderately prominent (Fig. 34); cercus long, slender, and distinctly bottle-shaped; antennal crescent divided. General colour grey, with prominent black markings on pleural region; hind femur yellow below, not conspicuously cross-

banded on outer surface; hind tibia blue, rarely pink; tegmina extending beyond apices of hind femora. Length 18-25 mm.

The species feeds on grasses.

Distribution.—From Alberta and British Columbia to Colorado. In the study area *alpinus* occurs on the montane parklands and grasslands of the foothills of southwestern Alberta as far eastward as Lethbridge, and in the Cypress Hills of southeastern Alberta (Map 6).

***Melanoplus angustipennis angustipennis* (Dodge)**

Caloptemus angustipennis Dodge, 1877, Can. Ent. 9: 111.

Male cercus small, symmetrical, and more or less spatulate with rounded apex, the narrowest part of centre (Fig. 21); supra-anal plate narrow and pointed on apical third, the median groove shallow; furculae moderately large, their apices divergent; apex of subgenital plate usually notched to a greater or lesser extent. Dorsal angle of ovipositor approximately 90 degrees; notch of eighth sternite moderately prominent (Fig. 36); cercus short, triangular; antennal crescent divided or very narrow. General colour brownish-grey; hind femur pale yellow, obscurely banded on outer surface above; hind tibia red or blue; tegmina reaching to just beyond apices of hind femora. Length 17-22 mm.

The species is a mixed-feeder, preferring grasses.

Distribution.—Two subspecies of *angustipennis* are recognized at present. *M. angustipennis impiger* Scudder occurs in Georgia, Arkansas, Kansas, Iowa, Oklahoma, Texas, and southeastern Minnesota. *M. angustipennis angustipennis* (Dodge) is known from Ontario to Alberta, and in Michigan, Indiana, Illinois, Iowa, Kansas, Montana, and Colorado.

In the study area *angustipennis* is one of the main species on sandy or "blow-out" land, either in the forest or grasslands. It has been collected throughout the entire area from eastern Alberta (Wainwright, Manyberries) to eastern Manitoba (Victoria Beach) (Map 6).

***Melanoplus bilituratus* (Walker)**

Caloptemus bilituratus Walker, 1870, Cat. Derm. Salt. Brit. Mus. 4: 679.

Caloptemus atlantis Riley, 1875, Ann. Rep. Ins. Mo. 7: 169.

Melanoplus mexicanus of authors, not Saussure.

In the Prairie Provinces two subspecies may be recognized, *atlantis* in the forested areas, *bilituratus* in the grassland areas. These may be separated as follows:—

Tegmina 1.70-1.90 (male) or 1.65-1.75 (female) as long as hind femur; hind tibia dark red; general colour dark brown or nearly black; tegmina dark or conspicuously spotted; forest area of Manitoba, Saskatchewan, and Alberta including the foothills

M. bilituratus atlantis (Riley)

Tegmina 1.45-1.65 (male) or 1.40-1.63 (female) as long as hind femur; hind tibia more often buff or blue, less often pink or red; general colour grey, greyish-yellow or greyish-brown; tegmina usually not conspicuously spotted except in parkland populations; grasslands and parklands of Manitoba, Saskatchewan, and Alberta

M. bilituratus bilituratus (Walker)

M. bilituratus atlantis (Riley).—Length 29-31 mm. Dark brownish-black, with dark markings present but more extensive and diffuse, and not contrasting with background; tegmina brownish-black, conspicuously spotted along middle line and on apical crossveins, but occasionally these markings obscured by the dark background; tegmina long and slender, not tapered, extending well beyond apices of hind femora, 1.70-1.90 times as long as hind femur in the male, 1.65-1.75 times hind femur in female; hind tibia red; hind femur discoloured yellow or pink beneath.

M. bilituratus bilituratus (Walker).—This subspecies occurs in two forms on the grasslands. Contrary to the subspecies *atlanis*, the smallest specimens with the shortest tegmina occur in the northern part of the range, while the largest specimens with longest tegmina occur in the dry south. The percentage of specimens with red hind tibia increases in the parklands of eastern Saskatchewan and Manitoba, and in British Columbia.

Minor form: Length 23-28 mm. Predominately grey, bluish-grey or brownish-grey, the dark markings not contrasting (specimens from the parklands are more brownish, with less tapered, more spotted tegmina); tegmina brownish-grey to grey, spotted along central line of basal half with small spots, the spots usually widely separated and in one row, and the apical third of the tegmina usually without markings; crossveins sometimes very faintly marked; tegmina somewhat tapered, extending beyond apices of hind femora, 1.46-1.58 times as long as hind femur in male, 1.40-1.50 times hind femur in female; hind tibia buff, blue, or red; hind femur often pale below in male, but female usually with a pink or red stripe below.

Major form: Length 27-34 mm. Grey to greyish-yellow, the dark markings contrasting; tegmina greyish-brown with a central line of smaller spots on basal two-thirds, and crossveins of apical third obscurely marked; tegmina not tapered, extending well beyond the apices of hind femora, 1.60-1.63 times as long as hind femur in male, 1.50-1.63 times hind femur in female; tibia buff or blue, or less commonly pink or red; hind femur usually with a pink stripe below.

The subspecies are mixed-feeders preferring forbs.

Distribution.—Four subspecies of *bilituratus* are recognized at present. *M. bilituratus atlanis* (Riley) occurs in the forested region of British Columbia, the Northwest Territories, northern half of Alberta, Saskatchewan, and Manitoba, Ontario, Quebec, Maritimes, and northeastern United States. *M. bilituratus bilituratus* (Walker) occurs in Vancouver Island, southern British Columbia, the grasslands of Alberta, Saskatchewan, and Manitoba, and the great plains of United States as far as Nebraska and Utah. *M. bilituratus* subsp. occurs from northern Florida to Philadelphia, westward to northeastern Texas, Oklahoma, Kansas, and southern Nebraska. *M. bilituratus* subsp. occurs from Texas, New Mexico, and Arizona to California, Utah, and Nevada.

In the study area *M. bilituratus atlanis* occurs throughout the eastern, northern, and western forests. *M. bilituratus bilituratus* occurs over the entire grasslands area, and is usually more abundant in the southern third. The major form of *bilituratus* is usually confined to a narrow strip south of a line from Medicine Hat, Alta. to Brandon, Man., but after a series of "good" grasshopper years, or in local dry spots, this form predominates on the grasslands.

***Melanoplus bivittatus* (Say)**

Gryllus bivittatus Say, 1825, J. Acad. Nat. Sci. Phila. 4: 308.

Male cercus large, flat, and boot-shaped; furculae very small (Fig. 20); subgenital segment broadly pointed. Female cercus broad, triangular; angle of upper valve of ovipositor about 156 degrees (Fig. 53); eighth sternite with conspicuous notch, the angle about 90 degrees. General colour dark yellowish-green with a pair of narrow, yellow, dorsal lines extending from eye to apices of tegmina; hind femur greenish-yellow with narrow, longitudinal, black lines on outer surface and on upper, inner edge of dorsal flange; hind tibia buff, bluish, or red; tegmina reaching to or beyond apices of femora (rarely shorter). Length 26-40 mm.

Specimens with deep red hind tibia are fairly common in the forested area

of eastern Manitoba, Ontario, Quebec, and in British Columbia, but only those with greenish-buff hind tibia have been collected in the grassland and parkland portion of the study area.

The species is a general feeder, preferring forbs.

Distribution.—Widespread throughout Canada and the United States except in southeastern United States.

In the study area *bivittatus* is common throughout the entire area, with a preference for moister, parkland habitats.

***Melanoplus borealis borealis* (Fieber)**

Caloptemus borealis Fieber, 1853, Lotos 3: 120.

Pezotettix junius Dodge, Can. Ent. 8: 9.

White and Rock (1945) recognized three subspecies of *borealis* in Alberta. These subspecies, *borealis*, *junius*, and *monticola*, were also recognized by Hebard.

Each of the three forms is very weak and unstable. Intermediates between forms are numerous. Each appears in specially suited habitats within the ranges of the others and is not geographically limited except in a general way. In this summary, therefore, these three "subspecies" are considered to be climatically induced forms appearing largely as responses to ecological and climatic conditions.

In Canada two forms of the subspecies *borealis* may be recognized:—

Major form (typical *borealis* and *monticola*).—Labrador, James Bay, Quebec, Ontario, Northwest Territories to the MacKenzie delta, northern Manitoba to northern Alberta, foothills of Alberta, Cypress Hills, and interior British Columbia. The largest specimens examined were from the James Bay area, the MacKenzie delta, and the Cypress Hills; the smallest were from Labrador and interior British Columbia.

Darker and more discoloured, with a greasy appearance; hind femur discoloured on outer surface, darker red beneath; tegmina extending to near apices of hind femora, 1.15 times as long as hind femur; male long tegmina extending well beyond hind femora, 1.53 times as long as hind femur. Female short tegmina extending to genicular portion of the hind femora, 1.15 times as long as hind femur; female long tegmina extending well beyond apices of femora, 1.55 times as long as hind femur. Male 19-26 mm. long; female about 28 mm. long.

Minor form (typical *junius*).—Southern Ontario, parklands of Alberta, Saskatchewan, and Manitoba.

Paler and more greyish-yellow; hind femur pale on outer surface, often only pink below, sometimes yellow; tegmina of short-winged form noticeably tapered, with the apices more pointed, and the spots absent or vague. Male short tegmina extending to posterior fourth of hind femora, 0.95 times as long as hind femur; male long tegmina extending well beyond apices of hind femora, 1.56 times as long as hind femur. Female short tegmina reaching to posterior fourth of hind femora, 0.96 times as long as hind femur; female short tegmina extending to beyond apices of hind femur, 1.48 times as long as hind femur. Male 17-23 mm. long; female 18-26 mm. long.

The species is a mixed-feeder.

Distribution.—Four subspecies of *borealis* are recognized at present. *M. borealis borealis* (Fieber) occurs from Labrador, Quebec, and New England westward to British Columbia and Alaska. *M. borealis stupefactus* (Scudder) is found at high elevations in southern Colorado and New Mexico. *M. borealis*

palaceus Fulton occurs in Montana, Washington, Oregon, California, and Utah. *M. borealis utahensis* Scudder occurs in Utah.

In the study area *borealis* is common in moist situations in the forest and parklands. It is often very local in distribution in the southern part of the parklands and in parkland-like situations within the grasslands (Map 7). A broad zone of intergradation from one form to the other occurs in the parkland area. The major form predominates in moister, and more elevated locations within this transitional zone; the minor form predominates in more open, drier, and lower localities.

***Melanoplus bowditchi canus* Hebard**

Melanoplus bowditchi canus Hebard, 1925, Proc. Acad. Nat. Sci. Phila. 72: 120.

Male cercus slender on apical half, enlarged at base, the apex rounded; furculae very large and flat with more or less truncate apices (Fig. 19); supra-anal plate broad, short, and saucer-like; apex of subgenital plate obtusely pointed; aedeagus as illustrated (Fig. 22). Dorsal angle of ovipositor approximately 90 degrees; notch of eighth sternite shallow (Fig. 33); cercus long and slender, the sides conspicuously concave; antennal crescent divided. General colouring a blend of grey and bluish-grey; mesepimeron mostly pale, the lateral pronotal stripe not continuous; tegmina finely speckled with darker spots; hind femur pale below, without crossbands on outer surface; hind tibia blue; tegmina extending to just beyond apices of hind femora. Length 19-30 mm.

The species feeds on sage brush, *Artemisia cana* Pursh.

Distribution.—Two subspecies of *bowditchi* are recognized at present. *M. bowditchi bowditchi* Scudder occurs in eastern Colorado, western Kansas, and in Nebraska. *M. bowditchi canus* Hebard is found in Montana, Wyoming, Colorado, Alberta, and Saskatchewan.

In the study area *canus* is confined to river valleys or deeply eroded areas in the valleys of the Red Deer, South Saskatchewan, and Milk Rivers from Lethbridge and Drumheller in southern Alberta, to Elbow, Sask. (Map 8). It appears to select sites at the bases of steep eroded banks, and is rarely found more than a few yards from this type of habitat, though the host plant may be generally distributed in the area.

***Melanoplus bruneri* Scudder**

Melanoplus bruneri Scudder, 1897, Proc. U.S. Natl. Mus. 20: 164.

Male cercus moderately large and flat, with more or less pointed apex, the axis curved dorsad; furculae large and long, pointed (Fig. 17); supra-anal plate long and rectangular with pointed apex, deeply grooved; subgenital plate long, produced upward behind; aedeagus as illustrated (Fig. 26). Dorsal angle of ovipositor about 130 degrees; notch of eighth sternite shallow; cercus triangular with upper edge nearly straight (Fig. 44); antennal crescent divided. General colour dark brown; hind femur yellow beneath, without pink stripe, and crossbands very weak; hind tibia dark red; tegmina extending to or beyond apices of hind femora. Length 22-29 mm.

White and Rock (1945) suggested that *bruneri*, "might well be relegated to racial status under *M. mexicanus* as it appears to be merely a boreal form of that species". The intermediates upon which this suggestion was based have proved, upon examination of the aedeagus, to be *M. bilituratus atlantis* (Riley).

The species is a mixed-feeder, preferring grasses.

Distribution.—Nipigon in Ontario to interior British Columbia, Michigan, Wisconsin, and Nebraska; and in the Rocky Mountains from Idaho, Washington, and Montana, to southern Colorado.

In the study area *bruneri* occurs in forested or semi-forested areas, in the northern parklands, in the Cypress Hills of southeastern Alberta, and in the Turtle Mountains of southern Manitoba (Map 9). Specimens are also occasionally collected in the parklands of central Saskatchewan and Manitoba.

***Melanoplus confusus* Scudder**

Melanoplus confusus Scudder, 1897, Proc. U. S. Natl. Mus. 20: 339.

Male cercus large, with broadly rounded dorsal arm and prominent, triangular, ventral projection; furculae moderately long, and pointed (Fig. 5); supra-anal plate triangular; subgenital plate short, the apex low and rounded-truncate. Dorsal angle of ovipositor approximately 90 degrees; notch of eighth sternite moderate; cercus short and triangular (Fig. 39); antennal crescent broad and complete. General colour greyish-brown; hind femur yellow below, not conspicuously banded on outer surface; tegmina extending to apices of hind femora; hind tibia greenish-blue or red. Length 16-25 mm.

M. confusus is the earliest species to reach maturity, appearing with *Aeropedellus clavatus* in June.

The species is a mixed-feeder preferring forbs. Sedges are also readily eaten.

Distribution.—New England to British Columbia, southward to Virginia and North Carolina, westward to Indiana, Oklahoma, Montana, Colorado, Arizona, and New Mexico.

In the study area *confusus* is a common and widespread species, preferring dry, sandy wastelands and hillsides, or sandy forest clearings. The northern records in the Prairie Provinces are Red Deer, Alta., Prince Albert and White Fox, Sask., and Neepawa and Roblin, Man.

***Melanoplus dawsoni* (Scudder)**

Pezotettix dawsoni Scudder, 1875, Dawson's Rept. Geol. 49th Parallel: 343.

Male cercus broad at base, curved to broadly rounded apex; furculae moderately large, pointed (Fig. 10); supra-anal plate triangular, a little flared toward apex, the grooves shallow; subgenital plate narrowly truncate, and slightly notched at apex. Female cercus triangular, the sides concave; dorsal angle of valve about 150 degrees; eighth sternite with shallow notch (Fig. 51); antennal crescent divided. General colour brown to brownish-grey, bright yellow on ventral surface, and with conspicuously banded abdominal tergites; hind femur green below, banded above; hind tibia red. Length 15-20 mm.

The species is primarily a forb-feeder, feeding on plants such as *Lupinus* spp., *Aster* spp., *Solidago* spp., *Thermopsis* spp., or *Pulsatilla* spp.

Distribution.—Bounded by the Rocky Mountains in the west, southward to New Mexico, eastward to Manitoba, Iowa, Nebraska, and Wisconsin; discontinuous in Ontario, Maine, Michigan, and New Hampshire.

In the study area *dawsoni* is widely distributed, preferring grassy pastures where short shrubs are growing. It is more common in the eastern part of the area and in the parklands.

***Melanoplus fasciatus* (Walker)**

Caloptenus fasciatus Walker, 1870, Cat. Derm. Salt. Brit. Mus. 4: 680.

Male cercus large, long, and strap-like, with broadly rounded apex; subgenital plate truncate to shallowly emarginate at apex; furculae small and blunt (Fig. 13). Dorsal angle of ovipositor valve about 142 degrees; eighth sternite with shallow notch (Fig. 48); female cercus long and triangular, with sides concave; antennal crescent divided. General colour dark brown; hind femur

red below and on inner surface, conspicuously crossbanded on outer surface; hind tibia dark red; tegmina usually extending just beyond centre of hind femora, but rarely beyond apices of hind femora. Length 19-27 mm.

The species is a mixed-feeder, preferring broad-leaved plants.

Distribution.—Newfoundland and Labrador to British Columbia, the southern limits approximately 40 degrees north latitude, but extending farther south in the mountains of Tennessee, Arkansas, South Dakota, Colorado, and New Mexico.

In the study area *fasciatus* may be collected under spruce and pine, or on ground-cedar or bearberry. It occurs in the forested area of the three Provinces, and in the Cypress Hills of southern Alberta (Map 10). The species has also been taken at St. Lazare, Man., and at Indian Head, Sask., on ground-cedar *Sabina horizontalis* (Moench) Rydb.

***Melanoplus femur-rubrum femur-rubrum* (DeGeer)**

Acrydium femur-rubrum DeGeer, 1773, Mem. Hist. Nat. Ins. 3: 498.

Male cercus broadest at base, tapered and curved to rounded-truncate apex; furculae long and pointed; subgenital segment bulbous, concave at apex; supra-anal plate more or less rectangular with short pointed apex, the dorsal grooves prominent (Fig. 15). Female cercus triangular with concave sides; dorsal angle of ovipositor about 133 degrees; eighth sternite with very shallow notch (Fig. 47); antennal crescent complete but narrow. General colour brown, the underside of abdomen and hind femur yellow and contrasting with rest of body; hind tibia dark red; tegmina extending beyond apices of hind femora. Length 19-26 mm.

The western form of *femur-rubrum* differs slightly from specimens collected in Ontario. In general, the western specimens are a little larger, the tegmina have less conspicuous spotting, and the hind femora are entirely yellow below.

The species is a mixed-feeder.

Distribution.—Two subspecies of *femur-rubrum* are recognized at present. *M. femur-rubrum propinquus* Scudder occurs in southeastern United States. *M. femur-rubrum femur-rubrum* (DeGeer) is found throughout United States and Canada except in southeastern United States.

In the study area *femur-rubrum* occurs throughout the entire area on nearly all soil types, but is abundant only in moister pastures and around sloughs.

***Melanoplus flavidus* Scudder**

Melanoplus flavidus Scudder, 1879, Proc. Boston Soc. Nat. Hist. 20: 74.

Male cercus broad at base, wholly slender apically to rounded apex; furculae broad, long, and flat with truncate apices; supra-anal plate broad and saucer-like with pointed apex; subgenital segment obtusely pointed at apex (Fig. 19); aedeagus as illustrated (Fig. 25). Female cercus long and slender with conspicuously concave sides; dorsal angle of ovipositor valve approximately 90 degrees; eighth sternite with shallow notch (Fig. 33); antennal crescent divided. General colouring a blend of brown and black; mesepimeron black; lateral pronotal stripe broad, continuous and black; tegmina not speckled; hind femur yellow below, and the outer surface with crossbands dorsally; hind tibia blue or purple; tegmina extending beyond apices of hind femora. Length 19-26 mm.

In the field *flavidus* often appears and acts like a small *foedus* or *packardii*. In structure, the species is very similar to *bowditchi canus*, from which it is separated with difficulty.

The species is a mixed-feeder preferring grasses.

Distribution.—Two subspecies of *flavidus* are recognized at present. *M. flavidus flavidus* Scudder occurs in Colorado and western Kansas northward to Manitoba, Saskatchewan, and Alberta. *M. flavidus elongatus* Scudder is found in Colorado, New Mexico, and Texas.

In the study area *flavidus* occurs in very sandy or blow-out areas within the grasslands and parklands throughout the entire area (Map 8).

***Melanoplus foedus* Scudder**

Melanoplus foedus Scudder, 1879, Proc. Boston Soc. Nat. Hist. 20: 69.

Melanoplus stonei Rehn, 1904, Ent. News 15: 85.

Melanoplus fluviatilis Bruner, 1897, Ann. Rept. Nebr. Bd. Agr. 1896: 136.

Melanoplus foedus appears to be a very plastic species that breaks into environmental forms and subspecies readily. The structure of the aedeagus is the only reliable guide for identification (Figs. 18, 24, 43), and no means of separating female *foedus* from the allied *packardii* have been found.

Three subspecies of *foedus* have been collected in the Prairie Provinces. These may be separated as follows:—

1. Hind tibia dark red; more brownish-black, with the pronotal stripes usually greatly reduced or absent; tegmen usually with a row of dark spots on basal half, and crossveins of apical half marked, especially in the females; hind femur often with conspicuous, oblique crossbands on upper half of outer surface; length 23-28 mm.; jackpine forests of eastern and northern Manitoba *M. foedus stonei* Rehn
Hind tibia blue or purple; general colour brownish-yellow or greenish-grey; tegmina usually without spots, or only spotted on central line toward base; outer surface of hind femur without crossbands below upper flange, but usually with longitudinal discolouration 2

2. Under surface of hind femur yellow; length 24-32 mm.; pronotal stripes very conspicuous; sandy parklands and grasslands of southern Manitoba and southern Alberta *M. foedus foedus* Scudder

Under surface of hind femur red or orange; length 22-25 mm.; dorsal surface of pronotum uniformly coloured; Lethbridge, Alta.? *M. foedus fluviatilis* Bruner

M. foedus fluviatilis Bruner was reported from Lethbridge by White and Rock (1945) on the basis of one teneral specimen. No additional specimens have been collected, and the record should be regarded as tentative until better material has been obtained.

Distribution.—Four subspecies of *foedus* are recognized at present. *M. foedus foedus* Scudder occurs in Oklahoma, Minnesota, North Dakota, South Dakota, southern Manitoba, and southern Alberta. *M. foedus stonei* Rehn is found in forested areas from New Jersey and Minnesota to eastern Manitoba. *M. foedus iselyi* Hebard occurs in Oklahoma and Texas. *M. foedus fluviatilis* Bruner occurs in Illinois, Minnesota, Iowa, North Dakota, South Dakota, Kansas, Montana, Colorado, and Oklahoma.

In the study area *foedus foedus* occurs in very sandy places in a few localities in southern Alberta (Lethbridge, Manyberries), and more generally on lighter soil in southern Manitoba. *M. foedus stonei* has been collected in the Sandiland Forest Reserve in eastern Manitoba, at Victoria Beach, in the Riding Mountain Park, and at Gillam, Man. (Map 11). No specimens have been collected in Saskatchewan.

***Melanoplus gladstoni* Scudder**

Melanoplus gladstoni Scudder, 1897, Proc. U. S. Natl. Mus. 20: 229.

Male cercus broad and strap-like, with nearly parallel sides; furculae small; subgenital segment scarcely produced apically; supra-anal plate broad with conspicuous but shallow depressions (Fig. 16). Female cercus short and triangular; dorsal angle of ovipositor valve about 136 degrees; eighth sternite with

moderately conspicuous notch (Fig. 38); antennal crescent divided. General colour brownish-grey with mottled appearance; pronotum often with pale laterodorsal lines or mostly pale; tegmina conspicuously mottled dorsally as well as laterally; hind femur flattened at base below (Fig. 56); hind femur yellow below, and outer surface with bands on upper half; tegmina extending to near tip of hind femora, or well beyond. Length 17-22 mm.

The species is a general mixed-feeder.

Distribution.—Great Plains from eastern Minnesota, Manitoba, northwestern Iowa, Nebraska, and Kansas, to the Rocky Mountains; also southward to New Mexico, Colorado, and Mexico.

In the study area *gladstoni* is a common species of the dry, short-grass prairies. The northern records in the Prairie Provinces are Banff and Wainwright, Alta., Saskatoon and Biggar, Sask., and Arnaud in eastern Manitoba.

***Melanoplus huroni* Blatchley**

Melanoplus huroni Blatchley, 1898, Psyche 8: 195.

Male cercus slender on apical half, broad at base; furculae small and bunt; subgenital plate with pointed tubercle at apex (Fig. 2). Female cercus slender and triangular, with concave sides; upper valve of ovipositor heavy but narrow, the dorsal angle about 150 degrees; eighth sternite without notch (Fig. 50); antennal crescent complete. General colour dark grey or black, the tegmina speckled dorsally; hind femur red below and on inner surface, with narrow crossbands on outer surface; hind tibia dark red; tegmina generally extending to third or fourth abdominal segment and strongly tapered, rarely extending to or beyond apices of hind femora. Length 23-30 mm.

A large, clumsy, inactive forest species found in clearings and along roadsides in spruce and jackpine forests.

Distribution.—From Michigan and Ontario to interior British Columbia; and in Minnesota, South Dakota, Nebraska, Montana, and Wyoming.

In the study area *huroni* has been collected only from a few localities in northern Alberta, and in the forests from central Saskatchewan to eastern Manitoba (Map 12). Specimens have also been collected in the parklands south of Saskatoon, Sask., far removed from evergreen trees.

***Melanoplus infantilis* Scudder**

Melanoplus infantilis Scudder, 1879, Proc. Boston Soc. Nat. Hist. 20: 65.

Male cercus bifid at apex, with a small, thumb-like, dorsal projection, and a straight, tapered, ventral arm; furculae very small; supra-anal plate triangular with deep median groove; subgenital plate slightly produced and with notched apex (Fig. 8). Female cercus slender, bottle-shaped with concave margins; dorsal angle of ovipositor valve about 130 degrees; eighth sternite with moderately deep notch (Fig. 40); antennal crescent divided. General colour light grey, the abdominal tergites dark at bases laterally; hind femur yellow below, obliquely crossbanded on outer surface; hind tibia pale blue; tegmina extending well beyond apices of hind femora in male, or to apices of hind femora in female. Length 16-19 mm.

The species is a mixed-feeder, preferring grasses.

Distribution.—Manitoba and Minnesota to British Columbia and Montana, southward to Nebraska and Colorado.

In the study area *infantilis* occurs throughout the entire grassland area, and extends well into the parklands and forests on dry, grassy pastures. The northernmost records are Edmonton, Alta., Montreal Lake, Sask., and Lake Winnipegosis, Man.

Melanoplus islandicus Blatchley

Melanoplus islandicus Blatchley, 1898, Psyche 8: 196.

Male cercus nearly conical, short; subgenital plate pointed at apex; furculae small and pointed (Fig. 1). Female cercus triangular, with nearly straight sides; dorsal angle of ovipositor valve about 156 degrees, the upper valve slender; eighth sternite with shallow notch (Fig. 52). General colour rich brown, the ventral surface pale; abdomen with broad, pale, dorsal line; hind femur pale below, not conspicuously crossbanded on outer surface; hind tibia red; tegmina present as short, oval pads that extend to second abdominal segment. Length 17-23 mm.

Distribution.—Minnesota and southern Manitoba to Ontario, Pennsylvania, Maryland, and Virginia.

In the study area *islandicus* occurs in rich, shady forests in eastern Manitoba (Map 12).

Melanoplus keeleri luridus (Dodge)

Caloptenus luridus Dodge, 1876, Can. Ent. 8: 11.

Male cercus bifid, the dorsal arm large and broad and with rounded apex, the ventral arm small, pointed, and thumb-like; subgenital plate truncate at apex; furculae represented only by oval swellings (Fig. 3). Female cercus short and triangular, the dorsal edge concave; upper valve of ovipositor moderately stout, the dorsal angle about 137 degrees; eighth sternite with very shallow notch (Fig. 45); antennal crescent complete but narrow. General colour brownish; hind femur yellow below, usually with a definite longitudinal black stripe on outer surface (Fig. 54); hind tibia dark red with black spot or band at base; tegmina not quite reaching apices of hind femora. Length 18-23 mm.

Distribution.—Two subspecies of *keeleri* are recognized at present. *M. keeleri keeleri* (Thomas) occurs in southeastern United States. *M. keeleri luridus* (Dodge) is known from Colorado, Utah, Montana, Idaho, and Alberta; and in the east from Manitoba, Ontario, and northern New England.

In the study area *luridus* is found on sandy or blow-out areas in southern Manitoba and eastern Saskatchewan, and on the sandy region south of Medicine Hat in eastern Alberta (Map 13).

Melanoplus kennicotti Scudder

Melanoplus kennicotti Scudder, 1878, Proc. Boston Soc. Nat. Hist. 19: 289.

Male cercus relatively large and rectangular with rounded apex, the apical portion depressed; furculae small; apex of subgenital plate truncate to rounded-acute (Fig. 9). Female cercus triangular; dorsal angle of ovipositor valve about 120 degrees; eighth sternite with shallow notch (Fig. 37); antennal crescent divided. General colour greenish-grey, often with posterior part of pronotum yellow; hind femur yellow below, obviously crossbanded on upper half of outer surface; hind tibia blue or buff; tegmina extending to apices of hind femora, speckled dorsally. Length 17-21 mm.

The subspecies definitely prefers forbs but will eat grasses and sedges.

Distribution.—Two subspecies of *kennicotti* are recognized at present. *M. kennicotti kennicotti* Scudder occurs in Alaska, British Columbia, Alberta, Saskatchewan, Montana, and Wyoming. *M. kennicotti nubicola* (Scudder) is recorded from Colorado.

In the study area *kennicotti* has been collected from various localities in the foothills of western Alberta, from the Cypress Hills and Wood Mountain area of the southern Alberta and Saskatchewan, and from localities in the South Saskatchewan River Valley as far northward as Saskatoon (Map 10).

***Melanoplus montanus* (Thomas)**

Platyphyma montanus Thomas, 1873, Syn. Acrid. N. Amer.: 155.

Male cercus narrow, strap-like, and tapered with round apex; subgenital plate rounded-acute at apex; furculae small (Fig. 4). Female cercus triangular, the sides slightly convex; upper valve of ovipositor robust, the dorsal angle about 136 degrees; eighth sternite with shallow notch (Fig. 42); antennal crescent divided. General colour dark brown or blackish; hind femur mottled below, conspicuously crossbanded; hind tibia red with black spot at base; tegmina present as small, oval pads that extend to second abdominal segment. Length 17-25 mm.

The species was recorded by Walker (1910) as *Podisma dodgei*.

Distribution.—Washington, British Columbia, southwestern Alberta, Montana, and Wyoming.

In the study area *montanus* has been collected only at Waterton, Pincher, Banff, and Lake Louise in western Alberta.

***Melanoplus occidentalis occidentalis* (Thomas)**

Caloptenus occidentalis Thomas, 1872, Prelim. Rept. U. S. Geol. Surv. Montana and Terr. 5: 453.

Male cercus very large and ear-like, the cerci converging over top of supra-anal plate; furculae very small; subgenital plate pointed at apex (Fig. 12). Female cercus short, broad, and flat; upper valve of ovipositor short and stout, the dorsal angle about 132 degrees; eighth sternite without notch (Fig. 41); antennal crescent divided. General colour dark grey; hind femur bright red below and on inner surface, inconspicuously banded on outer surface; hind tibia bright blue; tegmina extending to apices of hind femora or a little beyond. Length 18-22 mm.

The species is a mixed-feeder.

Distribution.—Two subspecies of *occidentalis* are recognized at present. *M. occidentalis occidentalis* (Thomas) occurs in Minnesota, North Dakota, South Dakota, Nebraska, Kansas, Arizona, Mexico, Utah, Idaho, Montana, Colorado, British Columbia, Alberta, and Saskatchewan. *M. occidentalis brevipennis* Bruner is known from western Colorado.

In the study area *occidentalis* has been collected from a few localities in southern Alberta and Saskatchewan (Map 7).

***Melanoplus oregonensis* (Thomas)**

Pezotettix oregonensis Thomas, 1875, Rept. Geol. Geogr. Expl. 100 Merid. 5: 888.

Melanoplus oregonensis triangularis Hebard, 1928, Proc. Acad. Nat. Sci. Phila. 80: 269.

General colour dark brown or greyish-brown; hind femur yellow below, not conspicuously crossbanded on outer surface; antennal crescent of female complete; tegmina reaching to second abdominal segment. Length 18-23 mm.

M. oregonensis triangularis Hebard differs from typical *oregonensis* in having the supra-anal plate of the male triangularly shield-shaped instead of tongue-shaped, and slightly longer than broad instead of much longer than broad. The two subspecies are very similar and intergradation is clearly evident (Hebard, 1928).

Distribution.—Three subspecies of *oregonensis* are recognized at present. *M. oregonensis oregonensis* (Thomas) occurs in Wyoming, Idaho, and southern Alberta. *M. oregonensis ascensor* (Scudder) is known from high elevations of the Rocky Mountains of Wyoming and Colorado. *M. oregonensis triangularis* Hebard occurs in southern Alberta, Idaho, and northwestern Montana.

In the study area the subspecies *triangularis* has been collected at Coleman.

Blairmore, Waterton, and on the Old Man River in the mountains of south-western Alberta. The subspecies *oregonensis* has been collected only at Carway in southern Alberta.

***Melanoplus packardii* Scudder**

Melanoplus packardii Scudder, 1878, Proc. Boston Soc. Nat. Hist. 19: 288.

M. packardii is very similar to *M. foedus* in colour, external appearance, and in the structure of the genital segments (Figs. 18, 43). The anterior process of the aedeagus, however, is hardly more projecting than the posterior process (Fig. 23). The females cannot be separated from *M. foedus* at present.

Two subspecies of *packardii* have been collected in the Prairie Provinces. These may be separated as follows:—

Hind femur with bands present only briefly at top of the upper ridge and on inner surface; hind tibia blue, purple, or pink; general colour bluish-grey (more yellowish in the south); length 27-32 mm.; grasslands and parklands

Hind femur with bands extending on both sides of upper ridge; hind tibia dark red; general colour dark brownish-black; length 23-21 mm.; jackpine forests of Saskatchewan and Alberta

M. packardii packardii Scudder

M. packardii subspecies

The species is a mixed-feeder, preferring forbs.

Distribution.—British Columbia to Minnesota; and in Kansas, Arkansas, Texas, New Mexico, Utah, Nevada, California, Iowa, Oklahoma, South Dakota, and North Dakota.

In the study area the forest subspecies of *packardii* has been collected in the dry jackpine forests at Prince Albert, White Fox, Nipawin, and Hudson Bay Junction in Saskatchewan, and near Edmonton, Alberta. It is very similar in activity and appearance to *M. foedus stonei* Rehn which occurs in similar habitats in Manitoba. Typical *packardii* occurs throughout the entire grassland area, preferring sandier, gravelly, or drift soil. Southern specimens are generally paler, and often have pink or reddish hind tibia.

***Melanoplus spretus* (Walsh)**

Caloptenus spretus Walsh, 1866, Pract. Ent. 2: 1.

Length 30-36 mm.; tegmina 1.75-1.93 times as long as hind femur in male, 1.69-1.75 times as long as hind femur in female. Robust, brownish-yellow to greyish with contrasting black markings on head, lateral lobes of pronotum, and pleurae. Pronotum more constricted (than *M. bilituratus atlanis*) and the two anterior sulci usually more deeply impressed; tegmina broad to rounded apices, and presenting an appearance of broadness in repose; tegmina extending well beyond apices of hind femora, pale brown to greyish and conspicuously spotted especially on apical half. Hind tibia dark red. Male genital segments very similar to *atlanis* but cercus slightly shorter, broader, and more pointed (Fig. 32); and subgenital plate shorter in proportion to width. Anterior sclerotized valve of aedeagus scoop-shaped with pointed apex, the valve twisted to the side and backward around the edge of the large, membranous posterior lobe (Figs. 28, 30).

M. spretus is very similar to the large, pale form of *M. bilituratus atlanis* (Riley) of interior British Columbia. Contrary to general opinion, however, it is not necessarily larger or with longer tegmina than all *atlanis*.

Distribution.—Apparently extinct. Before 1900 *spretus* was a widely distributed and noxious species of the western plains.

This species was apparently not native to Canada, and persisted only for one or two years after each invading swarm. The last Canadian specimens collected were taken by N. Criddle east of Brandon, Man., in 1902, and are now in the Brandon laboratory collection.

Genus *Phoetaliotes* Scudder

Phoetaliotes Scudder, 1897, Proc. Amer. Acad. Arts and Sci. 32: 202.

Genotype: *Pezotettix nebrascensis* Thomas.

Head disproportionately large in relation to thorax, being both high and wide; face noticeably slanted, especially below; pronotum slender, the sides appearing to converge posteriorly; median carina of pronotum present throughout. Male subgenital plate pointed or sub-tubercular at apex; cercus symmetrical, slender on apical half; furculae minute.

This genus is very closely allied to *Melanoplus*. Only one species is known.

***Phoetaliotes nebrascensis* (Thomas)**

Pezotettix nebrascensis Thomas, 1872, Prelim. Rept. U. S. Geol. Surv. Montana and Terr. 5: 455.

Length 21-28 mm. Slender brownish species, usually with upper surface of the head and pronotum pale; hind tibia bluish or purple. Tegmina usually short and pointed, extending only to second or third abdominal segment, but occasionally extending well beyond apices of hind femora.

The species is a very general grass-feeder.

Distribution.—From central Mexico to Alberta, eastward to Indiana, Illinois, Oklahoma, and Texas; westward to British Columbia, California, New Mexico, and Arizona.

In the study area *nebrascensis* is found in a variety of habitats in the mixed and true prairie of southern Alberta, southern Saskatchewan, and southeastern Manitoba (Map 14).

Genus *Schistocerca* Stål

Schistocerca Stål, 1873, Recensio Orth. 1. 64.

Genotype: *Gryllus* (*Locusta*) *tartaricus* Linnaeus.

A genus of very large species, mostly southeastern in distribution. Only one species occurs in the Prairie Provinces.

***Schistocerca lineata* Scudder**

Schistocerca lineata Scudder, 1899, Proc. Amer. Acad. Arts and Sci. 34: 465.

This species and *altacea* (Harris) are very similar and their separation depends upon the consideration of a series of characters. Froeschner (1954) recorded both species from Iowa, as well as a number of intermediates between the two.

The species is a forbs-feeder, preferring licorice root (*Glycyrrhiza* sp.).

Distribution.—From Alberta to South Dakota, Nebraska, Iowa, Kansas, Oklahoma, and eastern Colorado.

In the study area *lineata* has been collected from a few localities in the extreme southern part. It occurs in rough, eroded valleys at Medicine Hat, Comrey, and Manyberries, Alta., at Coronach, Sask., and near Lyleton, Man. (Map 5).

SUBFAMILY OEDIPODINAE

Face perpendicular or nearly so; antenna thread-like to somewhat flattened; vertex generally flat to depressed, the lateral foveolae present and often conspicuous. Pronotum moderately long, often wrinkled or with ridges and tubercles, the hind margin usually triangularly produced; median carina low or crested, cut by one or more sulci, sometimes only superficially so; lateral pronotal carinae usually weak or absent. Tegmina and wings fully developed; hind wing usually brightly coloured and with black crossband; stridulating pegs on the wing veins, the ridge on inner surface of hind femur bare. Species black

to pale yellowish-green, the majority greyish-yellow with the tegmina banded, blotched or spotted.

The loud crackling sounds made by most of the Oedipodinae during flight appear to be produced from a slackening and sudden tightening of the membrane between the stiff veins of the hind wing (Isely, 1936), or by striking the hind wings and tegmina together during flight (Fulton, 1930). The loudest and sharpest sounds are produced by species with hard, thickened veins in the hind wing (genera *Circotettix* and *Aeroboreutes*), and least by species with soft, slender wing veins (*Cammula* and *Stethophyma*).

The 17 genera of the study area may be divided into six main groups:—

Group 1. Face not slanting; foveolae of head variable, not prominent; median carina of pronotum low, superficially cut by one sulcus; lateral pronotal carinae strong, the constriction not great; pronotum short, obtuse behind; hind wings clear with slender veins. Genera *Stethophyma*, *Cammula*, and *Encop-
tolphus*.

Group 2. Face slanting; foveolae of head lateral; median carina of pronotum crest-like, superficially cut by one sulcus; lateral pronotal carinae weak in front, constricted; antenna somewhat flattened; pronotum pointed behind; hind wings clear, stained with dark. Genus *Chortophaga*.

Group 3. Face not slanting; foveolae of head prominent; pronotum roughened or tuberculate; median carina of pronotum generally moderate to low, cut by one sulcus; pronotum pointed behind; hind wings red or yellow with a black band. Genera *Arphia*, *Cratypedes*, *Pardalophora*, and *Xanthippus*.

Group 4. Face not slanting; foveolae of head small; pronotum smooth, the lateral carinae absent in front; median carina of pronotum crest-like, deeply cut by one sulcus; hind wings red, yellow, or black. Genera *Spharagemon* and *Dissosteira*.

Group 5. Face not slanting; pronotum less constricted; median carina of pronotum low, cut by two sulci; pronotum nearly smooth or somewhat wrinkled; species hairier; hind wings coloured and the veins often enlarged. Genera *Trimerotropis*, *Aeroboreutes*, *Circotettix*, and *Hadrotettix*.

Group 6. Face not slanting; pronotum constricted; median carina of pronotum high and sharp, deeply cut by two sulci; dorsal surface of pronotum ridged or tuberculate; species not hairy; hind wings coloured and the veins not enlarged. Genera *Metator*, *Trachyrhachys*, and *Derotmema*.

Key to Species

1. Median carina of pronotum cut by one sulcus, sometimes superficially so 2
 Median carina of pronotum cut by two sulci, the front one sometimes poorly
 impressed 15
2. Principal sulcus making a deep incision in median carina, the carina in front of
 sulcus high, sharp, and entire (Figs. 88, 89) 3
 The incision of principal sulcus shallow, or, the region anterior to sulcus very
 rough, pitted, wrinkled, or tuberculate 6
3. Hind wing black with pale yellow border; hind tibia yellow or buff; widespread
 Dissosteira carolina (Linnaeus) 4
 Hind wing yellow or white with black crossband; hind tibia orange or red 4
4. Hind tibia red, with broad, brown band next basal pale band; southern Manitoba
 Spharagemon bolli bolli Scudder 5
 Hind tibia orange or red, without a dark band 5
5. Median carina of pronotum very high and sharp, the incision made by sulcus
 deep and oblique (Fig. 88); tegmina speckled, but not clearly banded; wide-
 spread *Spharagemon collare* (Scudder)

- Median carina of pronotum low and more roof-like, the incision made by sulcus less deep, not oblique (Fig. 89); tegmina banded; southwestern
Spharagemon equale (Say)
6. Pronotum roughened, especially in front, the posterior half with small tubercles (Figs. 92, 93, 94) 7
Pronotum smooth or a little wrinkled in front, the posterior half without small tubercles 11
7. Median carina of pronotum high and sharp, nearly entire (Fig. 94) 8
Median carina of pronotum low, especially in front, the incision of sulcus conspicuous 9
8. Disk of hind wing deep red and crossband broad and intense; hind tibia brownish-black with pale band near base; widespread
Arphia pseudonietana pseudonietana (Thomas)
Disk of hind wing light red, orange, or yellow, and crossband narrower and more brownish; hind tibia pale with apical two-thirds somewhat darker; widespread
Arphia conspersa Scudder
9. Hind margin of lateral lobe of pronotum concave (Fig. 93); depression of vertex divided in front by a ridge (Fig. 96); southern half of area
Cratypedes neglectus (Thomas)
Hind margin of lateral lobe of pronotum nearly straight; depression of vertex not divided in front by a ridge 10
10. Median carina of pronotum distinct throughout (Fig. 92); tubercles of pronotum low and more like pebbling; widespread in parkland and forest
Pardalophora apiculata subspecies
Median carina of pronotum not distinct in front of sulcus; tubercles of pronotum large, and the surface very rough; widespread
Xanthippus corallipes subspecies
11. Median carina of pronotum very high and crest-like, the incision of sulcus superficial; widespread
Chortophaga viridifasciata (DeGeer)
Median carina of pronotum low, the incision of sulcus usually conspicuous 12
12. Tegmina without spots, pale yellowish-green 13
Tegmina with spots 14
13. Tegmen with a conspicuous pale yellow, longitudinal line on basal half; widespread in parkland and forest
Stethophyma lineatum (Scudder)
Tegmen without a yellow longitudinal line; widespread in parkland and forest
Stethophyma gracile (Scudder)
14. Hind tibia blue; tegminal bands conspicuous; hind wing clouded on apical third; grasslands
Encoptolophus sordidus costalis (Scudder)
Hind tibia yellowish to brown; tegmina irregularly spotted; hind wing not clouded; widespread
Cammula pellucida (Scudder)
15. Pronotum with supplementary carinae or tubercles 16
Pronotum without supplementary carinae or prominent tubercles 20
16. Latero-ventral corner of lateral lobe of pronotum produced as an acute point (Fig. 95) 17
Latero-ventral corner of lateral lobe of pronotum broadly rounded 18
17. Hind wing clear, faintly yellow basally, and with evidence of a darker band; grasslands
Trachyrhachys kiowa kiowa (Thomas)
Hind wing yellow or red with black crossband; grasslands
Metator pardalinus (Saussure)
18. Hind tibia yellow, mottled with brown; depression of head very deep, open behind, and with high central carina on anterior half; southwestern
Derotmema baydenii baydenii (Thomas)
Hind tibia red or orange; depression of vertex shallow with low carina on posterior half; widespread
Xanthippus corallipes subspecies
19. Radial (anal) veins of hind wing thickened; crossband of hind wing generally incomplete or absent 20
Radial (anal) veins of hind wing not thickened; crossband of hind wing usually broad and complete 22
20. Hind wings clear, darkened along veins and toward base; all radial veins thickened; widespread west of Manitoba
Aeroboreutes carlinianus carlinianus (Thomas)
Hind wings yellowish with incomplete crossband; inner radial veins not thickened 21
21. Second lobe of hind wing produced (Fig. 70); tip of hind wing darkened; forests
Circotettix verrucellatus (Kirby)
Second lobe of hind wing not produced (Fig. 69); tip of hind wing clear, eroded areas of grasslands
Circotettix rabula rabula Rehn & Hebard

22. Inner surface of hind femur dark blue; inner edge of black crossband of hind wing beyond centre of wing, the spur absent; eroded areas of south *Hadrotettix trifasciatus* (Say)
 Inner surface of hind femur not blue; inner edge of black crossband of hind wing before centre of wing, the spur present 23
23. Hind tibia red or orange 24
 Hind tibia yellow or bluish 27
24. Latero-ventral corner of lateral lobe of pronotum produced as a rounded point (Fig. 91); tegmina speckled; open sand dunes. *Trimerotropis agrestis* McNeill
 Latero-ventral corner of lateral pronotal lobe broadly rounded, not produced (Fig. 90) 25
25. Bands of tegmina definite and conspicuous; spur of hind wing extending less than half way to base of wing 26
 Bands of tegmina indefinite (Fig. 82); spur of hind wing extending more than half way to base of wing; widespread *Trimerotropis campestris* McNeill
26. Inner surface of hind femur reddish-yellow with a prominent black band on the apical half that is continuous with the band on the outer surface; southwest *Trimerotropis pistrinaria* Saussure
 Inner surface of hind femur black to preapical pale band, or black area broken in centre; southwest *Trimerotropis latifasciata* Scudder
27. Hind tibia bluish-brown with pale basal band; black band of hind wing extending to apex (Fig. 80); mountains *Trimerotropis suffusa* Scudder
 Hind tibia buff, without bands; apical third of hind wing clear 28
28. Hind wing clear with faint bluish tinge, the crossband faint or absent; eroded areas of southern Alberta *Trimerotropis sparsa* (Thomas)
 Hind wing yellow with black crossband 29
29. Tegmina evidently banded (sometimes wholly reddish); crossband of hind wing broader, the spur extending less than half way to base of wing (Fig. 83); alkaline spots throughout area *Trimerotropis pallidipennis salina* McNeill
 Tegmina not evidently banded; crossband of hind wing narrow toward front, the spur extending more than half way to base of wing (Fig. 81); sandy-alkaline spots in the southwest *Trimerotropis gracilis sordida* Walker

Genus *Aerochoreutes* Rehn

Aerochoreutes Rehn, 1921, Trans. Amer. Ent. Soc. 47: 172.

Genotype: *Oedipoda carliniana* Thomas.

This genus contains only one species. It is most readily recognized by the structure and colour of the hind wing — all radial veins enlarged; wing transparent with dark staining along veins and toward base.

Aerochoreutes carlinianus carlinianus (Thomas)

Oedipoda carliniana Thomas, 1870, Proc. Acad. Nat. Sci. Phila. 1870: 81.

Robust; light greyish-brown, through pink 'or reddish to dark purple. Tegmina with or without evident bands; hind wing transparent, darkened along veins and toward base, often with the entire inner half black. Length 32-44 mm.

Two forms occur in this region and may be separated as follows:—

Apex of hind wing produced (Fig. 67); tegmina with evident bands; inner half of hind wing usually black, more contrasting with outer portion; length 38-45 mm.; sandy-alkaline, eroded areas of southern border of Alberta and Saskatchewan major form

Apex of hind wing not produced (Fig. 68); tegmina more speckled than banded; inner half of hind wing darker, but the colour diffusing along veins; length 32-40 mm.; general west of the Assiniboine Valley on dark mud outcrops and summer-fallow fields minor form

The two forms are comparatively stable, and are generally easily separated both by morphology and by habitat. The whirring or clattering of the minor form is decidedly more even than that of the major form, making it possible to determine typical specimens before catching them.

In southern Saskatchewan and Alberta the two forms occur together, the minor form on bare, black-mud hillsides by preference, and the major form

on flat, sandy-alkaline outwashes where sage bush and greasewood are abundant. Intermediates between the two are very common, and usually more numerous than the parent types in areas where the two occur.

Both forms are very strong fliers and hoverers, and will remain for many minutes poised 25 to 50 feet above the earth. The whirring or clattering is continuous in very hot, dry weather.

The species is a grass-feeder, preferring *Agropyron smithii* Rydb. It occasionally will feed on broad-leaved plants.

Distribution.—Two subspecies of *carlinianus* are recognized at present. *A. carlinianus carlinianus* (Thomas) occurs on the northern Great Plains in Montana, Wyoming, Colorado, North Dakota, South Dakota, Manitoba, Saskatchewan, and Alberta. *A. carlinianus strepitus* Rehn is known from Wyoming, Colorado, Utah, Nevada, Washington, and British Columbia.

In the study area *carlinianus* is very common in the cultivated areas of Alberta and Saskatchewan as far northward as Wetaskawin, Prince Albert, and White Fox. It is rare and local in eastern Saskatchewan and western Manitoba (Map 15).

Genus *Arphia* Stål

Arphia Stål, 1873, Recensio Orth. 1: 113.

Genotype: *Gryllus sulphureus* F.

The species of *Arphia* are the most common and characteristic of the coloured-winged grasshoppers of the prairie region, occurring from early May to late September.

Two species are found in the study area, one in the spring, the other in late summer.

Arphia conspersa Scudder

Arphia conspersa Scudder, 1875, Proc. Boston Soc. Nat. Hist. 17: 514.

Light brown or brownish-black, often with a pale, longitudinal, central line on folded tegmina. Tegmina usually dark brown without speckling, but occasionally light brown and faintly speckled with black, the trailing edge often pale yellow. Disk of hind wing bright red, pale pink, reddish-orange, or yellow; crossband narrow, the apical third of hind wing clear or slightly smoky; spur very long, extending well toward base of wing (Fig. 78). Hind femur light brown on outer surface with faint, preapical pale band, or brownish-black with three prominent white bands; inner surface of hind femur and lower sulcus black to the preapical band, or the dark area broken at centre. Hind tibia usually pale greenish-brown with dark apex and darker ring at basal third. Length 26-35 mm.

Specimens with a pale mid-dorsal line occur more frequently in northern parklands; those with yellow hind wings are rare except in forested areas.

Adults have been collected from early May to September, the usual period being May to July. The life-cycle may be completed in one or two years. The flight is usually short and erratic. Both sexes making a crackling sound, that of the male being decidedly louder and sharper.

The species is a mixed-feeder, preferring grasses and sedges (*Stipa* spp., *Agropyron* spp., *Carex* spp. etc.).

Distribution.—From Alaska to Colorado, New Mexico, Utah, and Arizona, eastward to Minnesota, Iowa, and Nebraska.

In the study area *conspersa* occurs in forest clearings and on grasslands throughout the entire area. It prefers sandy or gravelly soil.

***Arphia pseudonietana pseudonietana* (Thomas)**

Tomonotus pseudonietanus Thomas, 1870, Proc. Acad. Nat. Sci. Phila. 1870: 82.

Brown to black, heavily speckled species, usually with contrasting white markings on head and pronotum. Head entirely dark brown to black, or greyish-white below, or dark brown with entire dorsal surface white. Pronotum dark brown to black, or with dorsal surface white. Tegmina pale grey and closely sprinkled with black, or very dark; disk of hind wing brilliant red, the crossband broad and black with long, sharp spur (Fig. 77); tip of wing dark or clear with dark flecks. Hind femur brown on outer surface with evidences of prebasal, central, and pregenicular pale bands, but these poorly developed and irregular; inner surface of hind femur and lower sulcus black to pregenicular band. Hind tibia dark purplish-brown with pale prebasal band. Length 30-35 mm.

The flight is short, slow, and erratic, at which times a loud crackling is produced, or fast and straight when a softer sound occurs. The species hibernates in the egg stage.

The species is a mixed-feeder, preferring grasses (*Calamovilfa* sp., *Koeleria* sp., *Bromus* sp., *Stipa* spp., *Agropyron* spp., etc.).

Distribution.—Two subspecies of *pseudonietana* are recognized at present. *A. pseudonietana pseudonietana* (Thomas) occurs from Ontario, British Columbia, and in Michigan, Wisconsin, Illinois, Iowa, western Kansas, New Mexico, Arizona, North Dakota, South Dakota, and Montana. *A. pseudonietana crassa* Bruner is recorded from Arizona and Mexico.

In the study area *pseudonietana* is found on dry, grassy uplands throughout the entire area south of the forest. Northernmost records are Ponoka and Canmore, Alberta; Lloydminster, Saskatoon, and Canora, Saskatchewan; Dauphin and Winnipeg, Manitoba.

Genus *Camnula* Stål

Camnula Stål, 1873, Recensio Orth. 1: 114.

Genotype: *Oedipoda pellucida* Scudder.

Only one species has been placed in this genus.

***Camnula pellucida* (Scudder)**

Oedipoda pellucida Scudder, 1862, Boston J. Nat. Hist. 7: 472.

Pale yellowish-brown to black species, the face and underside lighter. Tegmina when folded showing two posteriorly converging stripes, the remainder of tegmina nearly transparent with darker blotches; hind wing transparent, without markings, often a little yellow toward the base. Hind femur wholly pale on outer surface or with three narrow, oblique bars; hind tibia yellow or buff with considerable brown discolouring toward apex. Length 21-32 mm.

The species is primarily a grass- and sedge-feeder, *Carex* sp. preferred, followed by *Koeleria* sp. and *Stipa* sp. A few forbs are also readily eaten.

Distribution.—From Newfoundland to British Columbia; southern limits are northern Connecticut, northern Indiana, northern Illinois, western Nebraska, Utah, and California west of Sierra Nevada to the Mexican line. In the East the distribution goes south along the Appalachians to Virginia and in the West along the Rocky Mountains to New Mexico and the Arizona plateau.

In the study area *pellucida* may be collected throughout the entire area, being more common on the grassy plains, roadsides, and in alkaline s_2 ots.

Genus *Chortophaga* Saussure

Chortophaga Saussure, 1884, Mem. Soc. Phys. Hist. Nat. Geneve 28: 43.

Genotype: *Acrydium viridifasciatum* DeGeer.

This genus differs from our other oedipodine genera in the somewhat slanted face and flattened antenna. The pronotal crest is very high and sharp, and only superficially incised by the principal sulcus.

One of the two known species occurs in the study area.

***Chortophaga viridifasciata* (DeGeer)**

Acrydium viridifasciatum DeGeer, 1773, Mem. Hist. Nat. Ins. 3: 498.

Dichromatic; mostly green with a brown longitudinal area on upper part of folded tegmina, or entirely brown. Hind wing transparent, slightly yellowish toward base, and with dark brown staining on outer half (Fig. 64). Hind tibia bluish-brown to tan, always with pale prebasal band.

The flight is swift, and close to the ground; only a rapid clicking sound is made. The species overwinters in the nymphal stages, appearing as an adult in May and June.

The species is a grass-feeder.

Distribution.—From Montana and British Columbia to New Mexico and Utah, eastward to southern Ontario, southward to the Gulf Coast.

In the study area *viridifasciata* is widely distributed. It is common only in Manitoba where it occurs in grassy pastures, on golf courses, and lawns; in the western half of the area it is rather rare and occurs only around margins of sloughs.

Genus *Circotettix* Scudder

Circotettix Scudder, 1876, Bull. U.S. Geol. Geogr. Surv. Terr. 2: 264.

Genotype: *Oedipoda undulata* Thomas.

The genus is most readily recognized by the structure and colour of the hind wing — the outer radial veins are enlarged and the wing is transparent yellow with a narrow or broken crossband.

Two species have been collected in the Prairie Provinces.

***Circotettix rabula rabula* Rehn and Hebard**

Circotettix rabula Rehn and Hebard, 1906, Proc. Acad. Nat. Sci. Phila. 58: 393.

This species has a tendency to occur as local populations, and in this area a number of these populations may be recognized. Specimens collected in the Qu'Appelle Valley of eastern Saskatchewan and from western Manitoba are consistently darker and the crossband of the hind wing is broader and more complete; this eastern population was recorded as "atypical *rabula* toward *nigrafasciatus*" by Rehn (1921). Specimens collected in the foothills at Lundbreck, Alta. were consistently darker, with less spotting on the tegmina, and with broader, more complete crossband.

The typical *rabula* is generally light grey with dark speckling (Fig. 69). In the southern part of Saskatchewan, especially in the Souris Valley at Estevan, a large proportion of the specimens are wholly pink or purplish; these variants are very similar in general appearance to variants of *Aerochoreutes carlinianus* encountered in the southern eroded areas.

C. rabula prefers steep, bare, south-facing hillsides and eroded areas. It does not discriminate between gravel, clay, or shale; neither does the type of flora nor altitude appear to be significant. The flight is erratic and quick. The species will hover for long periods during dry, hot weather, making a very sharp, loud crackling noise that may be heard for a quarter of a mile or more.

The species was recorded from Alberta as *C. undulatus* (Thomas) by Walker (1910 p. 300).

The species is a mixed-feeder.

Distribution.—Three subspecies of *rabula* are recognized at present. *C. rabula nigrasfasciatus* Beamer occurs in Kansas, South Dakota, Nebraska, and Colorado. *C. rabula altior* Rehn occurs in New Mexico, Colorado, and Utah. *C. rabula rabula* Rehn and Hebard is known from British Columbia to Manitoba, and in Idaho, Montana, Utah, Wyoming, and Colorado.

In the study area *rabula* occurs in suitable habitats from Treesbank, Man. to Lundbreck and Drumheller, Alta. (Map 16). It is very abundant in the valleys of the Souris, Qu'Appelle, South Saskatchewan, Frenchman, Red Deer, and Milk Rivers, and has been collected from landslides at the highest point of the Cypress Hills (4,680 feet) at Elkwater, Alta.

***Circotettix verrucullatus* (Kirby)**

Locusta verrucullata Kirby, 1873, Richardson, Fauna Boreale Amer. 4: 250.

Nearly wholly black, or grey, mottled with black; crossband of hind wing generally complete, sometimes broken at centre; tip of wing usually dark, rarely clear; second lobe of hind wing produced (Fig. 70).

C. verrucullatus is similar to *C. rabula* in flight habits and in the type of crackling produced. It lives on exposed gravel, rock, sand, or clay banks along river courses and roadsides.

The species is a forbs-feeder, rarely feeding on grasses.

Distribution.—New England, Newfoundland, and Nova Scotia, northward and westward through Michigan, Minnesota, and Illinois in the boreal forests to Yukon and British Columbia.

In the study area *verrucullatus* occurs in suitable habitats within the forested area from southeastern Manitoba to western Alberta (Map 16). It is apparently replaced by *Trimerotropis suffusa* in the foothills of southern Alberta.

Genus *Cratypedes* Thomas

Cratypedes Thomas, 1876, Proc. Davenport Acad. Nat. Sci. 1: 257.

Genotype: *Oedipoda neglecta* Thomas according to Hebard (1928).

In this genus, a segregate of the former genus *Hippiscus* Saussure, the posterior margin of the lateral lobe of the pronotum is concave (Fig. 93). The depression of the vertex is closed in front and the central partition of the front originates in front (Fig. 96), the opposite condition to that prevailing in *Xanthippus* and *Pardalophora*, the other segregates from *Hippiscus*. Unlike our other members of the Hippisci, *Cratypedes* spp. hibernates in the egg stage.

Only one species has been collected in the study area.

***Cratypedes neglectus* (Thomas)**

Oedipoda neglecta Thomas, 1870, Proc. Acad. Nat. Sci. Phila. 1870: 81.

A dark grey species. Pronotum wholly dark, or dark with light grey lateral lines, or dark with a conspicuous pale apical border, or pale. Tegmina dark with two pale grey spots anteriorly and spotted toward the apex, often with a narrow yellow line dorsally; female tegmina paler; disk of hind wing yellow, with broad crossband and long spur (Fig. 74). Hind tibia reddish or orange. Length 27-37 mm.

The species is primarily a grass-feeder.

Distribution.—From Manitoba to British Columbia, southward to north-western New Mexico, northern Arizona, and California, and in the foothills of Montana and Wyoming.

In the study area *neglectus* occurs on the short, mixed-grass prairie in dry, sandy locations throughout southern Alberta, southern Saskatchewan, and southwestern Manitoba (Map 18).

Genus *Derotmema* Scudder

Derotmema Scudder, 1876, Ann. Rept. U.S. Chief Engineers, 1876, app. JJ: 513.

Genotype: *Oedipoda haydenii* Thomas.

Eyes very prominent and bulging; depression of vertex deep, extending over front, and with very prominent lateral and median ridges. Dorsal surface of pronotum very rough, and with longitudinal ridges and tubercles; tegmina long and narrow, tapered.

One species occurs in the southern part of the study area.

Derotmema haydenii haydenii (Thomas)

Oedipoda haydenii Thomas, 1872, Prelim. Rept. U.S. Geo Surv. Montana and Terr. 5: 460.

Small; grey to brownish-grey speckled with black. Tegmina brown or grey and speckled with black especially on costal and anal areas; disk of hind wing red or yellow; crossband of hind wing broad, the spur extending more than half way from band to base of wing (Fig. 66). Hind tibia brownish-yellow, mottled; inner surface of hind femur discoloured, brownish. Length 20-30 mm.

The species is a mixed-feeder, preferring grasses.

Distribution.—Four subspecies of *haydenii* are recognized at present. *D. haydenii haydenii* (Thomas) occurs from Alberta and Saskatchewan to New Mexico, eastward to the Dakotas, Nebraska, and Kansas. *D. haydenii rileyianum* Saussure occurs in the Great Basin, Snake River, and Colorado. *D. haydenii mesembrinum* Rehn is known from western Texas, and northern Mexico. *D. haydenii laticinctum* Scudder is recorded from Arizona.

In the study area *haydenii* occurs only in southeastern Alberta and southwestern Saskatchewan, and is never common (Map 21). It is found around the margins of wet spots in sandy-alkaline situations, often accompanied by *Trimerotropis pallidipennis salina*.

Genus *Dissosteira* Scudder

Dissosteira Scudder, 1876, Ann. Rept. U.S. Chief Engineers, 1876, app. JJ: 511.

Genotype: *Gryllus carolina* Linnaeus.

Hind wing black with pale yellow border. Median carina of pronotum high and sharp, deeply incised by principal sulcus.

One species has been collected in the study area.

Dissosteira carolina (Linnaeus)

Gryllus (*Locusta*) *carolinus* Linnaeus, 1758, Syst. Nat. ed. 10: 433.

A large, well-known species, readily recognized by the colour of the hind wing. This species has the largest wing spread of our grasshoppers.

In the Prairie Provinces *carolina* occurs on cultivated patches or dark shale outcrops. It appears to thrive best near human habitation, and is most commonly collected along roadsides, in parking lots, or in gardens. It is never common "in the wild".

The species is a mixed-feeder, preferring forbs.

Distribution.—From Nova Scotia to British Columbia and Alaska; southward to northern Florida, central Alabama, southeastern Mississippi, northern Texas, New Mexico, Arizona, and California.

Tofield and Edmonton are the northernmost localities of collection in Alberta; Waskesiu in Saskatchewan; Birtle and Victoria Beach in Manitoba.

Genus *Encoptolophus* Scudder

Encoptolophus Scudder, 1875, Proc. Boston Soc. Nat. Hist. 17: 478.

Genotype: *Oedipoda sordida* Burmeister.

One species occurs in the study area.

***Encoptolophus sordidus costalis* (Scudder)**

Oedipoda costalis Scudder, 1862, Boston J. Nat. Hist. 7: 473.

Thorax and head variable, greenish-white to mostly grey. Tegmina dark with two conspicuous white spots along anterior margin, the trailing edge and apex grey with a few darker spots; hind wing transparent, the apical third stained dark (Fig. 63). Inner surface of hind femur dark bluish-black on basal half, and with a darker band toward apex; hind tibia purplish-black with pale sub-basal band. Length 20-27 mm.

The subspecies produces a sharp, rapid clicking noise during flight.

The subspecies is a grass-feeder, preferring *Agropyron smithii* Rydb.

Distribution.—Two subspecies of *sordidus* are recognized at present. *E. sordidus sordidus* (Burmeister) occurs from New England and Ontario to Minnesota, Nebraska, and Kansas, southward to North Carolina, Tennessee, and Missouri. *E. sordidus costalis* (Scudder) occurs from Alberta, Montana, and Colorado to Manitoba, the Dakotas, Nebraska, Kansas, Oklahoma, and Texas.

In the study area *costalis* is a common species of dry hillsides and rangelands throughout the entire region south of the forest.

Genus *Hadrotettix* Scudder

Hadrotettix Scudder, 1876, Ann. Rept. U.S. Chief Engineers, 1876, App. JJ : 511.

Genotype: *Gryllus trifasciatus* Say.

Middle and discal area of tegmina closely reticulate; crossband of hind wing beyond centre. Median carina of pronotum nearly absent; anterior sulcus very shallow and often present only on sides of pronotum.

One species has been collected in the study area.

***Hadrotettix trifasciatus* (Say)**

Gryllus trifasciatus Say, 1825, Amer. Ent. 2: 34.

A large, reddish-brown to bluish-black species with conspicuously banded tegmina. Tegmina reddish-brown to black, the bands conspicuous and solid, the basal part usually brown or grey and the tip clear; disk of hind wing yellow; crossband broad, lying outside centre of wing, without spur (Fig. 86). Hind femur pale on outer surface and with a prominent, oblique, dark band just beyond centre; inner surface of hind femur deep bluish to pregenicular pale area; hind tibia red, a little yellow on outer surface near base. Length 29-44 mm.

H. trifasciatus is very similar to *Trimerotropis pistrinaria* in general appearance, but is larger, with longer antenna, different hind wing pattern, and the inner surface of the hind femur is deep bluish. It often occurs with *pistrinaria* on rather bare, gravelly hillsides. It is not a strong flier, moving only short distances at a time.

Distribution.—From southern Manitoba to Alberta southward to Montana, South Dakota, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Arizona, and Mexico.

In the study area *trifasciatus* occurs in the southern part from Medicine Hat, Alta., to Lyleton in southwestern Manitoba (Map 29).

Genus *Metator* McNeill

Metator McNeill, 1901, Proc. U.S. Natl. Mus. 23: 394.

Genotype: *Psinidia pardalina* Saussure.

The genus is very similar to *Trachyrhachys*. Foveolae of head small; pronotum less constricted, the median carina higher, and the surface smoother

than in *Trachyrhachys*. Tegmina without definite bands; hind wings coloured and with a crossband.

One species occurs in the study area.

***Metator pardalinus* (Saussure)**

Psinidia pardalina Saussure, 1884, Mem. Soc. Phys. Nat. Geneve 28: 162.

A large, yellowish-grey, mottled species. Tegmina grey with black blotches but no evident bands, the dorsal and lateral portions divided by a yellow line; disk of hind wing red or yellow; dark crossband moderately wide, the spur extending more than half way from band to base of wing (Fig. 65). Inner surface of hind femur and hind tibia blue, this colour often very dilute in large females. Length 28-37 mm.

The species is a grass- and sedge-feeder, feeding on a variety of species (*Agropyron* spp., *Andropogon* spp., *Stipa* spp., *Carex* spp., etc.).

Distribution.—North Dakota, Manitoba, Saskatchewan, Alberta, Montana, South Dakota, Nebraska, Kansas, Texas, Colorado, Utah, and Arizona.

In the study area *pardalinus* occurs throughout the dry, short-grass prairie to the edge of the parklands, and within the parklands on bare hillsides in the Qu'Appelle and Assiniboine valleys.

Genus *Pardalophora* Saussure

Pardalophora Saussure, 1884, Mem. Soc. Phys. Nat. Geneve 28: 83.

Genotype: *Oedipoda phoenicoptera* Burmeister.

Large, ash-brown or grey, heavy-bodied species, with large, dark spots on the tegmina. Transverse ridges absent on vertex; frontal costa constricted above antennal base; pronotum roughened, the median carina interrupted by one sulcus.

Of the four known species one occurs in Canada.

***Pardalophora apiculata* (Harris)**

Locusta apiculata Harris, 1835, in Hitchcock, Rept. Geol. Mass. 2: 576.

Two subspecies of *apiculata* occur in Canada. They may be separated as follows:—

Hind tibia and inner surface of hind femur bright red, the inner surface of hind femur usually darker on basal half; spots on tegmina darker and more discrete toward apex; black crossband of hind wing darker and usually complete in the female; male and female active fliers; more robust, the males 30-36 mm. long, the females 40-46 mm. long; clearings in pine and spruce forests.....*P. apiculata* subspecies

Hind tibia and inner surface of hind femur pale yellow, the inner surface of hind femur with basal half and an isolated spot or partial band black; spots on tegmina more brownish, absent or less discrete toward apex; black crossband of hind wing less intense, and usually incomplete in the female (Fig. 75); females apparently never flying; less robust, the males 25-32 mm. long, the females 35-40 mm. long; parklands

P. apiculata apiculata (Harris)

Intermediates between the two subspecies have been collected in the pine forests of southeastern Manitoba, and in similar situations at Prince Albert and Nipawin, Sask. Occasional specimens approaching the forest subspecies have been collected in the Qu'Appelle Valley at Indian Head, Sask., and near Brandon, Man. (Map 19).

In respect to distribution and the proportion of intermediates occurring in intermediate areas, it seems apparent that two climatically-induced forms are involved rather than valid subspecies. Future studies will be required to establish this point.

The subspecies feed mainly on grasses and sedges (*Agropyron* spp., *Poa* spp., *Carex* spp., etc.).

Distribution.—From Nova Scotia to British Columbia, northward to the upper MacKenzie River. Its southern limits are New Jersey, Kentucky, Oklahoma, and Colorado, and in the Appalachian Mountains it occurs in North Carolina and Tennessee.

In Canada the forest subspecies is known from Quebec, northern Ontario, eastern and northern Manitoba, northern Saskatchewan, northern Alberta, and the MacKenzie Valley. The subspecies *apiculata* occurs in the parklands of Alberta, Saskatchewan, and Manitoba, and in similar situations in southern Ontario.

Genus *Spharagemon* Scudder

Spharagemon Scudder, 1875, Proc. Boston Soc. Nat. Hist. 17: 467.

Genotype: *Gryllus aequalis* Say.

Three species of the genus occur in the study area.

Spharagemon bolli bolli Scudder

Spharagemon bolli Scudder, 1875, Proc. Boston Soc. Nat. Hist. 17: 469.

Rusty-brown, through dark grey, to nearly black species. Tegmina reddish-brown without conspicuous markings or nearly black with apex and partial bands lighter; disk of hind wing yellow; crossband broad, in centre of wing, and spur very short; apical third of wing clear (Fig. 72). Hind femur pale on outer surface with two dark bands or indications of bands; inner surface of hind femur pale yellow, black on basal half, and with black band apically; hind tibia distinctly red with sub-basal pale ring followed by a black ring. Median carina of pronotum moderately high, the incision of principal sulcus conspicuous but not sloped. Length 26-28 mm.

Distribution.—Two subspecies of *bolli* are recognized at present. *S. bolli bolli* Scudder occurs from Ontario to Manitoba, and in Minnesota, South Dakota, Nebraska, Oklahoma, Texas, and Colorado. *S. bolli inornatum* Morse is known from New Mexico.

In the study area *bolli* has been collected from southern Manitoba, east of the Assiniboine and Souris Rivers (Map 17). The species occurs on sandy soil in oak bluffs.

Spharagemon collare (Scudder)

Oedipoda collare Scudder, 1872, U.S. Geol. Surv. Nebr. Final Rept. 3: 250.

Head and pronotum dark grey to pale grey, the posterior half of pronotum more often white with small black spots. Tegmina grey, speckled with black, the bands inconspicuous; disk of hind wing yellow; crossband broad, and spur short (Fig. 71). Outer surface of hind femur mostly pale with two dark bands and a partial basal band; inner surface of hind femur pale with two dark spots or bands; hind tibia red, somewhat yellowish toward base on outer surface. Median carina of pronotum very high and sharp, the incision of principal sulcus deep and oblique (Fig. 88). Length 30-38 mm.

The species is a mixed-feeder, preferring grasses.

Distribution.—From southern Ontario to Alberta, Montana, and Wyoming, southward to Gulf of Mexico but southwestward and westward only recorded from Utah and southeastern Arizona.

In the study area *collare* is a common species of the open grassland, and open sandy locations within the forest. It occurs throughout the entire area.

Spharagemon equale (Say)

Gryllus aequalis Say, 1825, J. Acad. Nat. Sci. Phila. 4: 307.

Head and pronotum light grey, the posterior half of pronotum often white with a few dark spots, but rarely entirely pink. Tegmina light grey, the

basal portion and two bands darker; disk of hind wing yellow to nearly white; crossband broad with short spur (Fig. 73). Outer surface of hind femur pale with two darker bands dorsally; inner surface of hind femur yellow to orange, with two partial bands; hind tibia orange, a little yellow at base on outer surface. Median carina of pronotum low throughout, the incision of principal sulcus conspicuous but not oblique (Fig. 89).

The species is a mixed-feeder on range grass, and preferring the Cruciferae of the broad-leaved plants.

Distribution.—North Dakota, South Dakota, southern Minnesota, Iowa, Kansas, Oklahoma, Texas, Utah, interior British Columbia, Alberta, and Saskatchewan.

In the study area *equale* is fairly common in southwestern Saskatchewan from Elbow to Val Marie, and westward in southern Alberta to Calgary and Wainwright (Map 17).

Genus *Stethophyma* Fischer

Stethophyma Fischer, 1853, Orth. Eur. 297: 453.

Genotype: *Gryllus* (*Locusta*) *grossus* Linnaeus.

This genus differs somewhat from other oedipodine genera and is usually placed in the Acridinae.

Face slanting; lateral foveolae of head small or obsolete; antenna somewhat flattened toward base; pronotum short, convex at apex, and not pointed; median carina of pronotum low, superficially incised by principal sulcus; lateral carinae of pronotum entire; tegmina long and with open venation.

Two species have been collected in the study area.

Stethophyma gracile (Scudder)

Arcyptera gracilis Scudder, 1862, Can. Nat. and Geol. 7: 463.

Large olive-green species. Tegmina uniformly greenish-brown without markings; hind wings clear without markings. Hind femur greenish with lower surface wholly red; hind tibia greenish-yellow, with a diffuse darker band at basal third, the spines black. Male tegmina extending beyond apices of hind femora; female tegmina usually not reaching genicular portion of femora, but occasionally long.

The species is a sedge-feeder.

Distribution.—From Newfoundland to British Columbia southward to New England, Michigan, Minnesota, North Dakota, South Dakota, Nebraska, Colorado, and Montana.

In the study area *gracile* occurs in dense, tall, slough grasses and sedges around nearly dry ponds. It is very local, but with wide distribution in forest and parklands from southeastern Manitoba to central Alberta (Map 22).

Stethophyma lineatum (Scudder)

Arcyptera lineata Scudder, 1862, Boston J. Nat. Hist. 7: 462.

A large olive-green species with a conspicuous, longitudinal, yellow, subcostal stripe on basal half of tegmen. The female tegmina surpass the apices of hind femora, and the female flies as readily as the male.

The species is a sedge-feeder.

Distribution.—From Newfoundland to British Columbia southward to New Jersey, Pennsylvania, Indiana, Illinois, Iowa, Montana, and Washington.

In the study area *lineatum* has the same general habits as *S. gracile* but appears to prefer colder situations, and is collected in the long grass around springs and in bogs. The distribution is more restricted and slightly more northern than that of *gracile* (Map 23).

Genus *Trachyrhachys* Scudder

Trachyrhachys Scudder, 1876, Ann. Rept. U.S. Chief Engineers, 1876, App. JJ: 291.

Genotype: *Trachyrhachys coronata* Scudder.

Differs from *Metator* as follows: foveolae of head larger; pronotum more constricted; hind portion of pronotum tuberculate; tegmina banded; hind wing clear, with or without black band.

One species occurs in Canada.

Trachyrhachys kiowa kiowa (Thomas)

Oedipoda kiowa Thomas, 1872, Prelim. Rept. U.S. Geol. Surv. Montana and Terr. 5: 461.

A small, grey to greenish species with banded tegmina. Head and pronotum dark grey without obvious colour pattern, or greenish-yellow with a broad, black bar on side of head, a narrow, transverse, black bar on the vertex, a black spot on anterior propleura, and a black central line on anterior part of pronotum. Tegmina dark grey or nearly black, with two white, partial bands, or mostly light greyish-green with three darker bands; hind wing transparent and without markings, a little yellow at base. Basal half of inner surface of hind femur black, the apical half yellow with black band; hind tibia blue to black, paler at base. Length 18-26 mm.

The species is a grass-feeder.

Distribution.—Three subspecies of *kiowa* are recognized at present. *T. kiowa kiowa* (Thomas) occurs from Manitoba to British Columbia southward to Minnesota, Oklahoma, northern Texas, Montana, Utah, and Arizona. *T. kiowa thomasi* (Caudell) occurs in Nebraska, Minnesota, Illinois, Ohio, Texas, Arkansas, and Georgia, the western limits in Kansas and Oklahoma. *T. kiowa fuscifrons* (Stål) is a southeastern subspecies known from Pennsylvania, Ohio, Illinois, Oklahoma, Texas, Mississippi, Georgia, and southern Iowa.

In the study area *kiowa* is found throughout the dry grassland area, and locally on bare hillsides in the river valleys of the parklands.

Genus *Trimerotropis* Stål

Trimerotropis Stål, 1873, Recensio Orth. 1: 118.

Genotype: *Locusta maritima* Harris.

About 50 species of *Trimerotropis* are recognized at present in North and South America. Many of these appear to be only climatically-induced forms of other species, or at most rather weak subspecies. The genus is greatly in need of a critical revision as the published records are much confused.

In general the species become lighter in colour and with a less prominent wing band in southern localities. Unlike genera such as *Melanoplus* Stål, genital structures are of little value in separating species, the characters of importance being in the pronotum, tegmina, wings, and hind leg.

Eight species occur in the study area but only two of these are common and widely distributed.

Trimerotropis agrestis McNeill

Trimerotropis agrestis McNeill, 1900, Psyche 9: 32; 1901, Proc. U.S. Natl. Mus. 23: 433.

Sandy coloured, speckled with black. Tegmina sandy with numerous, scattered, dark spots; disk of hind wing yellow; crossband dark and broad, the spur extending about half way between band and base of wing (Fig. 79). Outer surface of hind femur sandy with small dark spots, and three faint, incomplete, dark bands; inner surface of hind femur reddish with a darker central spot, or reddish with the basal third wholly dark, and the apical third with a narrow black band; hind tibia red, yellowish on the outer surface toward base. Median carina of pronotum prominent in front of principal sulcus, moderately

prominent to apex behind. Lateral lobe of pronotum produced as a blunt point posteriorly (Fig. 91). Length 23-35 mm.

T. agrestis is collected only on bare yellow sand, and when disturbed will circle to rest on sand again. The flight is short and rather slow; both sexes make a moderately loud and sharp crackling sound just before landing.

The species has been reported from Alberta as *T. citrina* Scudder by Caudell (1908).

The species is a mixed-feeder.

Distribution.—From Alberta to Manitoba southward to South Dakota, Nebraska, eastern Colorado, and Montana.

In the study area *agrestis* has been collected on sand at Calgary and Manyberries, Alta.; in the Great Sand Hills, at Elbow, and at Pike Lake, Sask; and from a few localities near Brandon, Man. (Map 27).

***Trimerotropis campestris* McNeill**

Trimerotropis campestris McNeill, 1900, Psyche 9: 31; 1901, Proc. U.S. Natl. Mus. 23: 423.

Usually dark grey with black spots and mottlings, but frequently the entire head and pronotum light yellow without spots, or with lower half of head and posterior half of pronotum white with few small spots. Tegmina with much dark spotting, the bands narrow, irregular and broken; disk of hind wing yellow; crossband broad and black, the spur extending more than half way to base of wing (Fig. 82). Outer surface of hind femur mostly greyish-white with three dark bands; inner surface of hind femur reddish-orange with central dark spots and a narrow dark band at apical third; hind tibia red to orange, yellowish at the base on outer surface. Median carina prominent in front of sulcus, the anterior incision sometimes obsolete; carina line-like behind sulcus. Length 28-36 mm.

This species has been repeatedly reported from the Prairies as *T. monticola* Saussure.

The species is a mixed-feeder, preferring grasses.

Distribution.—From Manitoba to British Columbia southward to the Dakotas, Montana, and southern Colorado.

In the study area *campestris* is a common species of the open grasslands in the western half of the area, and occurs locally on dry hillsides and gravelly spots within the parklands. Calgary, Pincher, Vermilion, and Lacombe are western and northern limits in Alberta, and Carberry is the northeastern limit in Manitoba.

***Trimerotropis gracilis sordida* Walker**

Trimerotropis sordida Walker, 1902, Can. Ent. 34: 2.

A dull greyish-brown species without prominent markings. Tegmina grey with scattered black spots generally more concentrated toward base, but without any strong bands; disk of hind wing yellow; crossband moderately broad and black, the spur extending about two-thirds of the way to base of wing (Fig. 81). Outer surface of hind femur greyish-brown without obvious banding; inner surface of hind femur black to pregenicular pale band, or the black area broken beyond centre; hind tibia pale yellow or buff, with some brown mottling. Median carina of pronotum prominent throughout and incisions prominent. Length 28-35 mm.

T. gracilis sordida inhabits the rather bare sandy-alkaline flats, often in company with *T. latifasciata* and *Aeroboreutes carlinianus*. The flight is short and erratic. Both sexes make a moderately loud crackling or ticking sound.

The species is a mixed-feeder, preferring grasses.

Distribution.—Two subspecies of *gracilis* are recognized at present. *T. gracilis gracilis* (Thomas) is known from southern Wyoming, eastern Utah, Colorado, and central California. *T. gracilis sordida* Walker occurs from Alberta, Saskatchewan, and Montana through northern Idaho, northeastern Oregon, and eastern Washington to British Columbia.

In the study area *sordida* is found in southwestern Saskatchewan west of Moose Jaw and Willow Bunch, and westward in southern Alberta to near Lethbridge (Map 25).

***Trimerotropis latifasciata* Scudder**

Trimerotropis latifasciata Scudder, 1880, Second Rept. U.S. Ent. Commission. App. 2: 26.

A grey to reddish-brown species with prominently banded tegmina. Tegmina mostly grey or black, occasionally reddish-brown at base, with the dark bands conspicuous and the pale area between the bands somewhat constricted in centre; apical third of tegmina grey with scattered spots; disk of hind wing very pale yellow to nearly white; crossband very broad and black, the spur extending less than half way to base of wing (Fig. 84). Outer surface of hind femur pale grey with a few black spots and faint band; inner surface of hind femur entirely black to the pregenicular pale band, or this black area broken in centre by an irregular reddish area; hind tibia red, yellow at the base on outer surface. Median carina of pronotum not prominent, and sulci usually shallow (occasionally with median carina moderately prominent throughout). Length 29-46 mm.

T. latifasciata is found on rather bare, sandy-alkaline flats where the chief conspicuous vegetation is greasewood (*Sarcobatus* sp.) and sagebush. It is a strong and erratic flier, difficult to catch.

The species is a mixed-feeder, preferring the grass *Agropyron smithii* Rydb.

Distribution.—Alberta, Montana, Colorado, Nebraska, Utah, Texas, New Mexico, western Kansas, North Dakota, and Washington.

In the study area *latifasciata* has been collected only in southeastern Alberta and southwestern Saskatchewan (Map 28).

***Trimerotropis pallidipennis salina* McNeill**

Trimerotropis salina McNeill, 1900, Psyche 9: 33; Proc. U.S. Natl. Mus. 23: 436.

A greyish-brown to greyish-black species with conspicuous bands on tegmina (rarely red without evident bands). Tegmina pale grey with a large, basal, dark blotch, a narrow and irregular central band, and scattered spots on apical third; disk of hind wing pale yellow; crossband broad and black, the spur extending less than half way to base of wing (Fig. 83). Outer surface of hind femur mostly pale with darker blotches at base, near centre, and before pre-apical pale band, but the dark bands rarely distinct; inner surface of hind femur black on basal half or more, but the black usually broken by a pale spot; hind tibia yellow to buff with some brown mottling. Median carina of pronotum prominent in front of principal sulcus, line-like behind. Length 28-42 mm.

Two forms of *salina* have been collected in southern Saskatchewan. These may be separated as follows:—

Tegmina and body grey, the tegmina with evident bands; crossband of hind wing broad and entire	major form
Tegmina and body entirely pink, the tegmina either without markings or these very faint; crossband of hind wing less than half normal width, fenestrated or broken	minor form

The two forms occur together at Big Muddy, Sask. A few intermediates were collected in the same area in 1955.

The species inhabits bare alkaline flats and margins of alkaline sloughs. The flight is usually short and straight, and the insect stays fairly close to the ground. The crackling noise produced during flight is soft, more like the flutter of a small bird.

The species is a mixed-feeder, preferring grasses.

T. pallidipennis salina is very similar to the eastern subspecies *T. maritima interior* Walker, and has been reported from this region as *interior* by Hebard (1932). It differs from *interior* on the evenly rounded latero-ventral angle of the lateral lobe of the pronotum, on the broader tegmina, and on the more extensive dark markings of the inner surface of the hind femur; the crossband of the wing is also broader and the spur a little shorter than in *interior*. The species has been reported also as *T. latifasciata* Scudder by Walker (1910), and *T. vinculata similis* Scudder by Caudell (1908).

Distribution.—Two subspecies of *pallidipennis* are recognized at present. *T. pallidipennis pallidipennis* (Burmeister) is known from Montana, British Columbia, Colorado, and Texas, southward to Mexico and South America in the west. *T. pallidipennis salina* McNeill occurs from Montana and Alberta to Manitoba, southward to the Dakotas, eastern Nebraska, Oklahoma, and locally in Colorado.

In the study area *salina* occurs in suitable habitats throughout most of the area, and is common in southern Saskatchewan and Alberta (Map 24).

***Trimerotropis pistrinaria* Saussure**

Trimerotropis pistrinaria Saussure, 1884, Mem. Soc. Phys. Nat. Geneve 28: 173.

A brownish-grey species with prominently banded tegmina. Tegmina mostly pale grey to white, the basal portion grey to brown; middle pale band not constricted in centre; apical third of tegmina greyish or with a few vague spots; disk of hind wing pale yellow; crossband black and broad, the spur reaching less than half way to base of wing (Fig. 85). Outer surface of hind femur pale with moderately prominent black band; inner surface of hind femur entirely reddish-yellow with prominent black band at apical third, this band continuous with the band on the outer surface; hind tibia red, yellowish toward the base on outer surface. Median carina of pronotum line-like, the anterior sulcus sometimes absent. Length 30-36 mm.

T. pistrinaria inhabits dry, gravelly situations and hillsides. It is a moderately strong and erratic "circle-back flier"; the crackling noise is moderately loud but of short duration.

The species is a mixed-feeder, preferring forbs such as *Astragalus* spp.

Distribution.—Alberta, Saskatchewan, the Dakotas, western Nebraska, Colorado, Texas, and Wyoming.

In the study area *pistrinaria* has been collected on gravelly spots and hillsides in the southwestern part of the area, from Lumsden and Big Muddy, Sask., westward to Lethbridge and Gleichen, Alta. (Map 26).

***Trimerotropis sparsa* (Thomas)**

Oedipoda sparsa Thomas, 1875, Wheeler's Rept. Surv. w. 100 Merid: 883.

A light greyish species with darker markings. Tegmina grey with scattered darker spots forming poorly defined bands, the apical portion with few spots; hind wing clear or with bluish tinge, the crossband absent or faintly indicated. Hind femur pale on outer surface and without bands except on upper flange where they are diffuse; inner surface of hind femur black on basal half and with a black band on apical half; hind tibia greenish-buff with some brown mottling

toward base. Median carina of pronotum distinct in front of principal sulcus, line-like behind. Length 27-37 mm.

T. sparsa inhabits the bare, alkaline flats and hillsides in the eroded areas. The flight is short and erratic and a sharp crackling sound is produced, especially just before alighting.

Distribution.—North and South Dakota, northwestern Nebraska, Wyoming, Idaho, and southern Alberta.

In the study area *sparsa* is confined to a number of localities in southern Alberta (Map 27).

***Trimerotropis suffusa* Scudder**

Trimerotropis suffusa Scudder, 1876, Bull. U.S. Geol. Surv. Terr. 2: 265.

A very dark brown or black species without contrasting markings. Tegmina uniformly dark brown to black, a little paler toward the apex and with few darker blotches; disk of hind wing yellow; crossband and apical portion of wing black or brown; spur extending about half way to base of wing (Fig. 80). Outer surface of hind femur brown to black with darker mottlings on upper and lower flanges, and usually with a fairly well-marked, paler, pregenicular band; inner surface of hind femur black on basal half, and with a black band on apical half; hind tibia bluish-green, mottled with brownish toward base. Median carina of pronotum prominent in front, line-like behind. Length 33-40 mm.

T. suffusa inhabits bare, rocky areas, and is often rather common on areas of coal or dark shale outcrops.

Distribution.—British Columbia, western Alberta, Montana, Washington, California, and New Mexico.

In the study area *suffusa* has been collected in the foothills and mountain passes of southwestern Alberta as far northward as Banff (Map 25). It apparently replaces *Circotettix verrucullatus* (Kirby) in this area.

Genus *Xanthippus* Saussure

Xanthippus Saussure, 1884, Mem. Soc. Phys. Nat. Geneve 28: 46.

Genotype: *Oedipoda corallipes* Haldeman.

Great confusion has been evident in the taxonomy of *Xanthippus* and other genera of the Hippisci (Hebard, 1928). A number of species and races have been described from southern United States and Mexico, but most of these, as well as those from Canada, have been placed as races of *corallipes* Haldeman. A thorough revision will be necessary to adequately define, limit, and name the species and subspecies.

Two species are known in Canada, *vitellinus* Saussure in southern British Columbia, and the subspecies defined below.

***Xanthippus corallipes* subspecies**

Oedipoda montanus Thomas, 1872, Rept. U.S. Geol. Surv. Montana: 462.

Hippiscus latefasciatus Scudder, 1892, Psyche 6: 359.

Xanthippus corallipes buckelli Hebard, 1928, Proc. Acad. Nat. Sci. Phila. 80: 241.

Four rather distinct subspecies may be recognized in Western Canada, two occurring in the Prairie Provinces. These may be separated as follows:—

1. Hind tibia yellow on basal half, and yellow to pink on the apical half; inner surface of hind femur pink or red to the pale preapical annulus, the upper part often with diffuse darkening; depression of vertex without conspicuous crossbars; tegmina speckled with small, irregular, dark spots; disk of hind wing yellow; Reindeer Depot, MacKenzie Delta, N.W.T. *X. corallipes* subspecies
- Hind tibia reddish or orange, at least on inner surface; tegmina more yellowish with larger, more regular markings 2

2. Inner surface of hind femur with ventral flange on the basal half, and often the area above bluish-black; hind tibia continuously reddish on inner surface, but with varying degrees of yellow to wholly yellow on outer surface; depression of vertex generally without conspicuous crossbars; interior British Columbia

X. corallipes buckelli Hebard
Hind femur wholly deep red on inner surface; hind tibia red to orange, usually yellowish on basal third of outer surface 3

3. Depression of vertex without conspicuous crossbars (Figs. 98, 99), the bars generally weaker than the central partition and not entire, frequently absent 4

Depression of vertex deep, divided or partially divided by conspicuous ridges that are about as strong as central partition (Fig. 97); hind wing generally without spots at apex; hind tibia deep red on inner surface, the same shade as femur; broader, paler forms; grasslands of Alberta, Saskatchewan, and Manitoba
X. corallipes latefasciatus (Scudder) minor form

4. Pale brown or olive-brown forms, the markings of the tegmina and femur faint and indefinite; head and pronotum less tuberculate; body more robust; hind wing generally without spots at apex; spur of hind wing well removed from base, the wing band narrow and often broken or windowed; hind tibia deep red; extreme southern Alberta and southwestern Saskatchewan eroded areas

X. corallipes latefasciatus (Scudder) major form
Mostly dark with distinct black blotches on tegmina and femur; head and pronotum more tuberculate; body narrower; hind wing generally with spots at apex; spur of hind wing extending to or near base, the wing band broad and black; hind tibia orange to reddish-orange; sandy areas in spruce and pine forests of western Manitoba and central Saskatchewan *X. corallipes montanus* (Thomas)

The two subspecies occurring the Prairie Provinces (*latefasciatus* on the open plains and *montanus* in the forest) are not difficult to separate in series. The grassland subspecies is much paler, broader, and more robust than the forest subspecies; it is much more active and flies long distances in a straight line. The forest subspecies flies only a few yards and tends to move erratically.

The major form of *latefasciatus* differs both in morphology and colour from the normal form. The vertex is nearly flat and without bars (as in *Pardalophora*, Fig. 99); the pronotum is much less rugose; the wing band is often scarcely half of the normal width and tends to be broken or fenestrate as in *Pardalophora* (Fig. 75); the general colour is pale brown to olive-green, and the tegminal spots are faded in appearance. The major form has been collected only in the extreme southern, eroded portion of the study area (Map 20). Intermediates between the major and minor forms are very numerous and occur with typical specimens of each.

The subspecies *montanus* occurs as two local populations. The population from the sandy lands in western Manitoba is decidedly paler, with smaller and more scattered tegminal spots, and more orange hind tibia than the central Saskatchewan population.

Xanthippus subsp. hibernate in the egg stage (first year) and as partially grown nymphs (second year). They are primarily grass-feeders but will eat some forbs.

General Distributions of Subspecies Occurring in Canada.—*X. latefasciatus montanus* (Thomas) is known from the upper Snake River plains, Montana, South Dakota, Nebraska, Kansas, Colorado, New Mexico, Arizona, Manitoba, Saskatchewan, and Alberta. *X. latefasciatus latefasciatus* (Scudder) occurs from Montana and Alberta to Manitoba, South Dakota, Nebraska, Wyoming, and Colorado. *X. latefasciatus buckelli* Hebard occurs in British Columbia, Oregon, Washington, Montana, and Nevada. The unnamed subspecies is known to me only from Reindeer Depot, N.W.T.

SUBFAMILY ACRIDINAE

Face usually slanting; antenna conspicuously flattened to thread-like; vertex, flat, or depressed, the foveolae absent or present; pronotum short, the hind margin truncate, or obtusely angled (acute in *Acrolophitus*); median carina of pronotum low and not crested (except in *Acrolophitus*), cut by one sulcus; lateral carinae of pronotum usually strong; tegmina and wings long or short; hind wings clear and unbanded (except in *Acrolophitus*); stridulating pegs on a ridge on inner surface of hind femur, the wing veins bare. Species small to moderately large, generally slender, and variously coloured.

All species, except those of the genera *Eritettix* and *Psoloessa*, have a normal life-cycle of one year and hibernate in the egg stage. The species stridulate readily, but do not make the loud crackling noise during flight as do the Oedipodinae.

The 18 genera found in study area may be divided into six main groups.

Group 1. Antenna strongly flattened and broadened toward base, three-angled in cross-section; face conspicuously slanting; foveolae of head absent; pronotum not constricted. Genera *Mermiria*, *Opeia*, and *Pseudopomala*.

Group 2. Antenna somewhat flattened toward base, but not three-angled in cross-section; face oblique; foveolae of head absent; pronotum not noticeably constricted. Genera *Chloealtis*, *Neopodismopsis*, *Eritettix*, and *Amphitornus*.

Group 3. Antenna thread-like; face moderately oblique; foveolae of head present but not visible from above; pronotum somewhat constricted. Genera *Orphulella* and *Cordillacris*.

Group 4. Antenna thread-like; face somewhat oblique; foveolae of head present and visible from above except in *Phliostrota*; pronotum constricted. Genera *Chorthippus*, *Aeropedellus*, *Ageneotettix*, *Aulocara*, *Drepanopterna*, *Psoloessa*, *Phliostrota*, and *Bruneria*.

Group 5. Including the single genus *Acrolophitus*, which differs from other acridine genera in the pointed, crested pronotum, and the banded hind wings.

Key to Species

1. Hind wing banded; median carina of pronotum high and crest-like behind sulcus; face ascending to a pointed cone; pronotum acute behind *Acrolophitus hirtipes* (Say) 2
- Hind wings not banded; median carina of pronotum low; face not ascending to a pointed cone; pronotum obtusely rounded behind 3
2. Antenna strongly flattened and broadened toward base, three-angled in cross-section (Fig. 118) 3
- Antenna thread-like to somewhat flattened, round or oval in cross-section 5
3. Vertex of head without a median carina (Fig. 118); southern eroded areas *Mermiria maculipennis macclungi* Rehn 4
- Vertex of head with a median carina (Figs. 116, 117) 4
4. Prosternum with a low, obtuse tubercle; outer margin of hind tibia with 14-17 spines; southwestern eroded areas *Pseudopomala brachyptera* (Scudder) 18
- Prosternum without a tubercle; outer margin of hind tibia with 10-12 spines; southern grasslands *Opeia obscura* (Thomas) 19
5. Lateral foveolae of vertex absent or not visible from above 6
- Lateral foveolae of vertex visible from above 14
6. Vertex of head without a median carina, the vertex depressed behind the anterior margin (Figs. 113, 114) 7
- Vertex of head with a median carina, at least in front 10
7. Lateral carinae of pronotum present and as strong as the median carina (Fig. 114) 8
- Lateral carinae of pronotum absent, their position marked only by colour lines (Fig. 113) 9
8. Lateral carinae of pronotum obviously constricted in front of sulcus, the lateral

- carinae more widely spaced at posterior margin of pronotum than at anterior (Fig. 114); widespread in alkaline areas.....*Orphulella pelidna pelidna* (Burmeister)
- Lateral carinae of pronotum more evenly curved, concave but not constricted, the posterior margin only slightly more widely spaced than anterior (Fig. 115); southern Manitoba.....*Orphulella speciosa* (Scudder)
- 9 Tegmina with dorso-lateral and dorsal area brown, the pale markings of the costal margin invading the brown as a series of broad, regular teeth (Fig. 111); south-eastern Alberta.....*Cordillacris crenulata crenulata* (Bruner)
- Tegmina grey to brown with a series of elongate spots (Fig. 112); on sand dunes.....*Cordillacris occipitalis cinerea* (Bruner)
10. Lateral carinae of pronotum very strongly constricted, the distance between the carinae at their closest less than half that at posterior edge (Fig. 100); tegmina with four or five conspicuous black spots in a row; southwestern grasslands.....*Ptilobostroma quadrimaculatum* (Thomas)
- Lateral carinae of pronotum subparallel or a little constricted, the distance between the carinae at their closest about four-fifths that at posterior edge (Figs. 119, 120); tegmina without large spots..... 11
11. Inner spurs of hind tibia unequal; antenna flattened and broadened toward apex; southwestern grasslands.....*Eritettix simplex tricarinatus* (Thomas)
- Inner spurs of hind tibia approximately equal; antenna thread-like..... 12
12. Hind tibia blue; slender, striped species with the hind femur pale yellow below; widespread on grasslands.....*Amphitornus coloradus* (Thomas)
- Hind tibia reddish or brown; brownish, non-striped species with the hind femur bright red below..... 13
13. Tegmina showing close longitudinal venation except along costal margin, the tegmina broadly rounded at apices; tegmina of female not broadened, extending to fourth abdominal segment; area above antenna black; general in forest and parklands.....*Chloealtis conspersa* (Harris)
- Tegmina showing widely spaced venation; costal area of female tegmina unusually broad, the tegmen sharply pointed at apices and extending only to base of third abdominal segment; area above antenna not black; widespread.....*Neopodismopsis abdominalis* (Thomas)
14. Hind tibia blue; foveolae of head triangular (Fig. 105)..... 15
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15. Tegmina extending to apices of hind femora; inner spurs of hind tibia slightly unequal; greenish or brownish-grey species; southwestern grasslands.....*Aulocara elliotti* (Thomas)
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- Antenna not enlarged at apex; lateral pronotal carinae evenly curved but not constricted; tegmina of female extending at least to middle of fifth abdominal segment; widespread.....*Chorthippus longicornis* (Latreille)
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- Inner spurs of hind tibia slightly unequal (Fig. 107); tegmina transparent, shining, and extending to apices of hind femora; widespread on grasslands.....*Bruneria brunnea* (Thomas)

Genus *Acrolophitus* Thomas

Acrolophitus Thomas, 1871, Prelim. Rept. U.S. Geol. Surv. 1870: 278.

Genotype: *Gryllus birtipes* Say.

Antenna long and slender, with the basal segments a little flattened and oval in cross-section. Face moderately slanted, ascending to a conspicuous, pointed cone; lateral foveolae and depression of vertex absent. Pronotum with a high semi-circular crest on posterior two-thirds, and with apex long and pointed; lateral carinae not evident; median carina cut by three sulci. Tegmina long, opaque, and closely reticulate toward base dorsally; hind wings with a broad black band.

***Acrolophitus hirtipes* (Say)**

Gryllus hirtipes Say, 1825, Amer. Ent. 2: 34.

A large, green, hairy species with red antennae and banded hind wings. Length 30-40 mm.

The species is a forbs-feeder, preferring species of the Boraginaceae (*Lithospermum* spp., *Lappula* spp., *Cryptantha* spp., *Phasuba* spp., etc.).

Distribution.—Alberta, Saskatchewan, Montana, North Dakota, South Dakota, Nebraska, Kansas, Texas, New Mexico, and Colorado.

In the study area *hirtipes* has been collected on sandy areas in river valleys of the southwestern half of the area (Map 30). The distribution is discontinuous.

Genus *Aeropedellus* Hebard

Aeropedellus Hebard, 1935, Ent. News 46: 186.

Genotype: *Gomphocerus clavatus* Thomas.

Apical segments of antennae broadened and flattened, especially in male. Face slanting; lateral foveolae of head conspicuous, narrow-rectangular, and visible from above (Fig. 102); depression of vertex without a carina, plane. Lateral carinae of pronotum entire, strongly constricted; median carina evident for entire length, cut by one sulcus; posterior margin of pronotum obtuse; prosternum with a small tubercle. Tegmina short, with open venation; hind wing clear. Inner spurs of hind tibia slightly unequal.

***Aeropedellus clavatus* (Thomas)**

Gomphocerus clavatus Thomas, 1873, Rept. U.S. Geol. Surv. Terr. 5: 96.

Male usually dull greenish-black with apex of antenna conspicuously flattened, broadened, and black; tegmina extending to tip of abdomen. Females variable in colour, the pronotum and head often marked with a conspicuous pattern of creams, greens, and black; antenna only slightly wider at apex; tegmina extending only to base of fourth abdominal segment. Length 17-19 mm.

The species is a grass and sedge-feeder, sometimes causing extensive damage to range grasses.

Distribution.—Minnesota through southern Canada to Yukon and Alaska, and in Iowa, the Dakotas, Nebraska, Colorado, Wyoming, and southward to New Mexico.

In the study area *clavatus* is the most widely distributed and abundant of our prairie species, occurring on all dry and somewhat sandy situations south of the forest. It is one of the earliest of summer grasshoppers to reach maturity, appearing with *Melanoplus confusus* in early June.

Genus *Ageneotettix* McNeill

Ageneotettix McNeill, 1897, Psyche 8: 71.

Genotype: *Chrysocraon deorum* Scudder.

Antenna slender, slightly flattened toward base. Face slanting; lateral foveolae conspicuous, rectangular, and visible from above (Fig. 103); depression of vertex without median carina. Lateral carinae of pronotum very weak except behind sulcus, the lateral margin of pronotum cut by three sulci; median carina strong throughout, cut by one sulcus; posterior margin of pronotum rounded;

prosternum without a tubercle. Tegmina not reaching apices of hind femora, opaque; hind wings clear. Inner spurs of hind tibia conspicuously unequal (Fig. 106).

***Ageneotettix deorum deorum* (Scudder)**

Chrysobraon deorum Scudder, 1876, Bull. Geol. Geogr. Surv. Terr. 2: 262.

A mottled brown species, yellowish below, occasionally with a pale mid-dorsal line from head to tip of tegmina. Tegmina opaque and whitish, with diffuse, brown spotting. Hind tibia orange with a pale ring at base. Length 15-20 mm.

The subspecies is primarily a grass-feeder, but also feeds extensively on dry debris.

Distribution.—Two subspecies of *deorum* are recognized at present. *A. deorum deorum* (Scudder) occurs in Alberta, Saskatchewan, and Manitoba, southward to northern Texas and New Mexico, eastward to Michigan, Indiana, and Oklahoma. *A. deorum curtippennis* Bruner occurs in northern Arizona, and southwestern Colorado.

In the study area *deorum* is a common species of sandy blow-outs and sparsely grown fields, as far northward as Allistair and Carstairs in Alberta, Battleford in Saskatchewan, and Brandon in Manitoba. It has not been collected east of Carberry, Man. (Map 38).

Genus *Amphitornus* McNeill

Amphitornus McNeill, 1897, Proc. Davenport Acad. Nat. Sci. 6: 223.

Genotype: *Stenobothrus coloradus* Thomas.

Antenna slender, slightly flattened toward base. Face slanting; lateral foveolae very shallow, not visible from above; depression of vertex with a median carina. Lateral carinae of pronotum absent or nearly so, the lateral margins rounded; median carina low, cut by one sulcus; prosternum without a tubercle; posterior margin of pronotum rounded. Tegmina extending beyond apex of abdomen; hind wings clear. Inner spurs of hind tibia approximately equal.

***Amphitornus coloradus coloradus* (Thomas)**

Stenobothrus coloradus Thomas, 1873, Rept. U.S. Geol. Surv. Terr. 5: 82.

A brownish-yellow species with a pair of broad, dark lines from apex of head onto tegmina. Tegmen with a white line on basal third. Hind femur pale with conspicuous black bands on upper half; hind tibia blue or purple. Length 19-24 mm.

The subspecies feeds on several species of grasses such as *Stipa* sp., *Bouteloua* sp., *Agropyron* sp., and *Bromus* sp.

Distribution.—Three subspecies of *coloradus* are recognized at present. *A. coloradus saltator* Hebard occurs in Nevada and Utah at high altitudes. *A. coloradus ornatus* McNeill occurs from British Columbia southward to Nevada. *A. coloradus coloradus* (Thomas) occurs from Alberta, Washington, Colorado, and Utah, eastward to Manitoba, Illinois, Iowa, and Kansas.

In the study area *coloradus* is a very common species of the grasslands as far northward as Rochester and Wainwright, Alta., North Battleford and Saskatoon, Sask., and occurs in southwestern Manitoba as far eastward as Carberry. In eastern Saskatchewan parklands it is confined to small, grassy spots, mostly along river valleys.

Genus *Aulocara* Scudder

Aulocara Scudder, 1876, Bull. U.S. Geol. Surv. Terr. 2: 266.

Genotype: *Stauronotus elliotti* Thomas.

Antenna slender, slightly flattened toward base. Head large and tumid;

face somewhat slanted; lateral foveolae conspicuous, triangular, and visible from above (Fig. 105); depression of vertex without a carina. Lateral carinae of pronotum weak or absent, the lateral margin of pronotum cut by three sulci; median carina weak in front, cut by one sulcus; posterior margin of pronotum obtuse; prosternum without a tubercle. Tegmina extending beyond apex of abdomen, opaque; hind wings clear. Inner spurs of hind tibia slightly unequal.

***Aulocara elliotti* (Thomas)**

Stauronotus elliotti Thomas, 1870, Proc. Acad. Nat. Sci. Phila. 1870: 82.

A dark greyish-brown species usually with pale mid-dorsal line evident on tegmina. Bands on outer surface of hind femur not conspicuous; hind tibia, and often the under and inner surface of the hind femur, blue. Tegmina opaque with diffuse brown spotting. Length 20-27 mm.

The species is a grass-feeder, attacking many species.

Distribution.—British Columbia to Manitoba southward to North Dakota, South Dakota, Montana, Nebraska, Kansas, Oklahoma, Texas, New Mexico, and Oregon.

In the study area *elliotti* is a common and widely distributed species of the grasslands northward as far as Cochrane, Alex, and Lavoy, Alta., and Lloydminster and Prince Albert, Sask. In the eastern half of Saskatchewan and in Manitoba the species is very local on dry, grassy hillsides as far eastward as the Red River.

Genus *Bruneria* McNeill

Bruneria McNeill, 1898, Psyche 8: 71.

Genotype: *Stenobothrus brunneus* Thomas.

Antenna slender, slightly flattened toward base. Face somewhat slanted; lateral foveolae conspicuous, rectangular, and visible from above (Fig. 104); depression of vertex shallow, with a nearly obsolete median carina. Lateral carinae of pronotum strong throughout, curved; median carina strong, cut by one sulcus; posterior margin of pronotum rounded; prosternum without a tubercle. Tegmina long, shining; hind wings clear. Inner spurs of hind tibia slightly unequal (Fig. 107).

***Bruneria brunnea* (Thomas)**

Stenobothrus brunneus Thomas, 1871, Prelim. Rept. U.S. Geol. Surv. Wyoming and Terr. 2: 280.

A variable species; head and pronotum usually black above with a yellow mid-dorsal line, but sometimes wholly white, or wholly brown without contrasting markings. Tegmina shining, conspicuously spotted. Length 18-25 mm.

The species feeds on several species of grasses and sedges such as *Koeleria* spp., *Carex* spp., *Bouteloua* spp., *Stipa* spp., or *Agropyron* spp.

Distribution.—Manitoba, Saskatchewan, Alberta, British Columbia, North Dakota, South Dakota, Nebraska, Colorado, Idaho, Montana, and Wyoming.

In the study area *brunnea* is a moderately abundant species of the grasslands. It is widely distributed in southern Alberta as far northward as Jasper and Edmonton, and in southwestern Saskatchewan northward to Lloydminster and Prince Albert. In eastern Saskatchewan and in Manitoba the species is very local on suitable hillsides, and in Manitoba is known only from Lyleton, Deloraine, and Pilot Mound in the south.

Genus *Chloealtis* Harris

Chloealtis Harris, 1841, Rept. Ins. Mass. Inj. Veget. : 148.

Genotype: *Locusta conspersa* Harris.

Antenna slender, slightly flattened toward base. Face slanting; lateral

foveolae absent; depression of vertex with a faint median carina. Lateral carinae of pronotum complete and nearly parallel, or somewhat constricted (Fig. 119); median carina strong, cut by one sulcus; posterior margin of pronotum truncate; prosternum without a tubercle. Tegmina short, rounded at the apices, and showing close longitudinal venation; costal region not broadened; hind wings clear. Inner spurs of hind tibia approximately equal.

***Chloealtis conspersa* (Harris)**

Locusta (*Chloealtis*) *conspersa* Harris, 1841, Rept. In: Mass. Inj. Veget. 1841: 149.

Male dark brown, the sides of pronotum and base of abdomen black; tegmina light brown and not noticeably spotted, usually extending to eighth abdominal segment, but occasionally beyond apices of hind femora. Female large, pale brown to grey with the sides of pronotum not contrastingly black; tegmina conspicuously speckled, and usually extending only to fourth abdominal segment. Hind tibia and underside of hind femur dark red. Length 16-25 mm.

The species is a grass-feeder.

Distribution.—Ontario and New England southward to Virginia, North Carolina, and northern Arkansas; westward to British Columbia and Nebraska.

In the study area *conspersa* is widely distributed in the forests and parklands, and locally in parkland habitats of the Cypress Hills and Wood Mountains (Map 36).

Genus *Chorthippus* Fieber

Chorthippus Fieber, 1852, in Ketch. Grundle. Orth. Obersehles: 1.

Genotype: *Acrydium albomarginatus* DeGeer.

Antenna long and slender, a little flattened toward base. Face slanting; lateral foveolae of head conspicuous, narrow-rectangular, and visible from above (see Fig. 102); depression of vertex without a carina, plane. Lateral carinae of pronotum strong, evenly curved; median carina strong, cut by one sulcus; posterior margin of pronotum rounded; prosternum without a tubercle. Tegmina short or long; hind wing clear. Inner spurs of hind tibia slightly unequal.

***Chorthippus longicornis* (Latreille)**

Acrydium longicorne Latreille, 1804, Hist. Nat. Crust. Ins. 12: 159.

A greenish-yellow species, usually with dark lines on head and sides of pronotum. Length of tegmina variable, usually extending to tip of abdomen in male and to fifth abdominal segment in the female, but occasionally extending beyond apices of hind femora in both sexes. Length 16-22 mm.

The species feeds on several species of grasses and sedges, preferring *Carex* spp., *Agropyron* spp., and *Koeleria* spp.

Distribution.—Europe and northern Asia; from British Columbia to Newfoundland, southward to New Jersey, North Carolina, Nebraska, Montana, and along mountains to New Mexico but absent from the southern Great Plains.

In the study area *longicornis* is a very widely distributed species throughout the entire area. It prefers marshy land or depressions, and is local in the grasslands.

Genus *Cordillacris* Rehn

Cordillacris Rehn, 1901, Can. Ent. 33: 271.

Genotype: *Stenobothrus occipitalis* Thomas.

Antenna slender, somewhat flattened toward base. Face slanting; lateral foveolae large and shallow, not visible from above; depression of vertex without a carina (Fig. 113). Lateral carinae of pronotum absent, their position indicated by constricted colour lines; median carina virtually absent in front of sulcus, low behind; prosternum without a tubercle; hind margin of pronotum rounded.

Tegmina long and opaque; hind wings clear. Inner spurs of hind tibia approximately equal.

***Cordillacris crenulata crenulata* (Bruner)**

Ocbrilidia ? *crenulata* Bruner, 1889, Proc. U.S. Natl. Mus. 12: 51.

Tegmina opaque and whitish, the costal region without spots but the middle region with four of five broad, dark markings that project as blunt teeth from the continuously dark anal region (Fig. 111). Yellow lines of pronotum conspicuously constricted in centre, the male and female about equal in this respect. Hind femur pale below; hind tibia buff. Length 13-18 mm.

The subspecies is a grass-feeder.

Distribution.—Two subspecies of *crenulata* are recognized at present. *C. crenulata crenulata* (Bruner) is known from Montana and Wyoming, southward to Colorado and northern Texas. *C. crenulata prima* Rehn occurs in Arizona and New Mexico.

In the study area *crenulata* has only been collected in the eroded valley of the Lost River in southeastern Alberta (Map 31).

***Cordillacris crenulata crenulata* (Bruner)**

Ocbrilidia ? *cinerea* Bruner, 1889, Proc. U.S. Natl. Mus. 12: 52.

Tegmina opaque, whitish; costal region usually with a row of brown spots, at least in male; middle region with a row of dark spots, these moderately discrete and not extending as blunt teeth from the brownish anal region (Fig. 112). Pale lines of pronotum only moderately constricted, more so in male. Length 15-22 mm.

The subspecies feeds on several species of grasses such as *Sporobolus* spp., *Agropyron* spp., or *Stipa* spp.

Distribution.—Two subspecies of *occipitalis* are recognized at present. *C. occipitalis occipitalis* (Thomas) occurs from Montana, eastern Colorado, and New Mexico, to Nebraska and South Dakota. *C. occipitalis cinerea* (Bruner) occurs from Alberta to Manitoba, southward to North Dakota, Montana, Wyoming, and Colorado.

In the study area *cinerea* is confined to sandy areas, river valleys, and eroded areas. It is moderately abundant in southern Alberta and western Saskatchewan. Carberry, Manitoba is the only recorded collection east of central Saskatchewan (Map 31).

Genus *Drepanopterna* Rehn

Drepanopterna Rehn, 1927, Trans. Amer. Ent. Soc. 53: 226.

Genotype: *Aulocara femoratum* Scudder.

Antenna slender, slightly flattened toward base. Head large and tumid; face slanting; lateral foveolae shallow, triangular; depression of vertex deep, without a median carina. Lateral carinae of pronotum weak or absent except behind sulcus; lateral margin of the pronotum cut by three sulci; median carina present throughout, cut by one sulcus; posterior margin of pronotum rounded; prosternum without a tubercle. Tegmina not reaching apex of abdomen, opaque and closely veined; hind wing clear. Inner spurs of hind tibia unequal.

***Drepanopterna femoratum* (Scudder)**

Aulocara femoratum Scudder, 1899, Proc. Amer. Acad. Arts and Sci. 25: 55.

A brownish-yellow species with pronotum dark at sides in front of sulcus. Tegmina opaque, and brown, with a few, small, dark specks. Hind femur pale with conspicuous black bands, both on inner and outer surfaces; hind tibia blue or purple, black at base. Length 19-20 mm.

The species is a grass-feeder.

Distribution.—Saskatchewan, Alberta, Montana, Idaho, Colorado, and Utah southward to Arizona and Mexico; eastward to South Dakota, Nebraska, and Texas.

In the study area *femoratum* has been collected only in a few localities in deeply eroded valleys of the Milk, Lost, and Frenchman Rivers (Map 32).

Genus *Eritettix* Bruner

Eritettix Bruner, 1890, Proc. U.S. Natl. Mus. 12: 56.

Genotype: *Eritettix variabilis* Bruner.

Antenna flattened, especially toward base and apex, oval in cross-section. Face slanted; lateral foveolae shallow, not visible from above; depression of vertex with a median carina (Fig. 120). Lateral carinae of pronotum strong, nearly parallel or somewhat constricted; median carina low, cut by one sulcus; prosternum without a tubercle; posterior margin of pronotum obtuse. Tegmina extending to near apex of abdomen; hind wings clear. Inner spurs of hind tibia conspicuously unequal.

Eritettix simplex tricarinatus (Thomas)

Stenobothrus tricarinatus Thomas, 1873, Rept. U.S. Geol. Surv. Terr. 5: 84.

Male about 16 mm. long, grey or greyish-brown, with a pair of narrow, dark lines on head and pronotum; lateral lobes of pronotum and thorax darker; tegmina rather uniformly coloured, dark grey with some pale streaks in costal region and toward apex. Female about 21 mm. long, robust, grey, and with contrasting dark and cream markings, or bright green with cream and dark lines; tegmina brownish to green with a row of dark markings. Hind femur pale below, longitudinally discoloured on outer surface; hind tibia buff, mottled with brown. Length 16-24 mm.

The subspecies is a grass-feeder.

Distribution.—Two subspecies of *simplex* are recognized at present. *E. simplex simplex* (Scudder) occurs from Connecticut southward to Georgia and westward to Illinois, Kansas, Oklahoma, and eastern Texas. *E. simplex tricarinatus* (Thomas) is known from North Dakota, Minnesota, Iowa, South Dakota, Nebraska, Wyoming, Colorado, Montana, Alberta, and Saskatchewan.

In the study area *tricarinatus* is fairly common on grassy hillsides in southeastern Alberta and southwestern Saskatchewan (Map. 32). It is rarely collected.

Genus *Mermiria* Stål

Mermiria Stål, 1873, Recensio Orth. 1: 90.

Genotype: *Opomala neomexicana* Thomas.

Antenna strongly flattened toward base, triangular in cross-section. Face strongly slanting; lateral foveolae very shallow, not visible from above; depression of vertex without a carina. Thorax slender; lateral carinae absent; median carina moderately strong, cut by one sulcus (Fig. 118); posterior margin of pronotum rounded; prosternum with a small tubercle. Tegmina extending to apex of abdomen; hind wings clear. Inner spurs of hind tibia approximately equal.

Mermiria maculipennis macclungi Rehn

Mermiria maculipennis macclungi Rehn, 1919, Proc. Acad. Nat. Sci. Phila., 1919: 111.

A pale brown or yellowish-grey species. Side of head and pronotum with a broad black stripe; tegmina pale with an opaque, yellowish subcostal stripe on basal third. Hind tibia reddish. Length 30-45 mm.

The subspecies is a grass-feeder, preferring taller grasses such as *Bouteloua curtipendula* (Michx.) Torr., and *Calamovilfa longifolia* (Hook.) Scribn.

Distribution.—Two subspecies of *maculipennis* are recognized at present. *M. maculipennis maculipennis* Bruner occurs in southern Kansas, in Oklahoma, and in Texas. *M. maculipennis macclungi* Rehn is known from Illinois, Wisconsin, central South Dakota, Missouri, Nebraska, Kansas, Colorado, Utah, Montana, Alberta, and Saskatchewan.

In the study area *macclungi* is known from a few localities in the eroded valleys south of Manyberries, Alta., and near Coronach in southern Saskatchewan (Map 33).

Genus *Neopodismopsis* Bei-Bienko

Neopodismopsis Bei-Bienko, 1932, Eos 8: 56.

Antenna slender, slightly flattened toward base. Face slanting; lateral foveolae absent; depression of vertex with faint median carina. Lateral carinae of pronotum complete, evidently curved or constricted in some females; median carina strong, cut by one sulcus; prosternum with a very small tubercle; posterior margin of pronotum rounded. Tegmina short, more pointed at apices, the male tegmen with open venation; costal area of female tegmen greatly broadened; hind wings clear. Inner spurs of hind tibia approximately equal.

Neopodismopsis abdominalis (Thomas)

Chrysobracon abdominalis Thomas, 1873, Rept. U.S. Geol. Surv. Terr. 5: 74.

A greyish-brown species; sides of male pronotum darker above; tegmen of male mostly transparent with some vague spotting in central region, the anal area opaque and yellowish. Female much larger than male and more uniformly coloured; tegmina usually short and pointed, occasionally extending to beyond apices of hind femora. Hind femur red below; hind tibia brown, darker toward apex.

The species feeds on several species of grasses and sedges such as *Carex* spp., *Bouteloua* spp., *Stipa* spp., *Agropyron*, spp. or *Koeleria* spp.

Distribution.—Ontario, Michigan, Minnesota, the Dakotas, Manitoba, Saskatchewan, Alberta, and British Columbia; southward to New Mexico.

In the study area *abdominalis* is very widely distributed throughout the forest and parklands. On the grasslands it is confined to depressions and valleys (Map 37).

Genus *Opeia* McNeill

Opeia McNeill, 1897, Proc. Davenport Acad. Nat. Sci. 6: 214.

Genotype: *Oxycoryphus obscurus* Thomas.

Antenna conspicuously flattened toward base, triangular in cross-section. Face strongly slanting; lateral foveolae of head present but shallow and not visible from above; depression of vertex with a median carina (Fig. 117). Lateral carinae of pronotum strong throughout, approximately parallel; median carina strong, superficially cut by principal sulcus behind middle; prosternum with a tubercle; apex of pronotum truncate. Tegmina not reaching apex of abdomen; hind wings clear.

Opeia obscura (Thomas)

Oxycoryphus obscurus Thomas, 1872, Prelim. Rept. U.S. Geol. Surv. Montana and Terr. 5: 466.

Small greyish-yellow to greenish species. Male small, pale greyish-brown or greenish with diffuse darker markings on head and thorax; tegmina brownish with a line of black spots in central region. Female moderately large, paler than male, and usually with contrasting green or dark markings on sides of pronotum and head. Hind femur pale with a darker streak dorsally; hind tibia pale bluish-green to brownish-yellow. Length 13-25 mm.

The species is a grass-feeder, preferring *Agropyron smithii* Rydb.

Distribution.—Montana and Alberta, eastward to Minnesota and western Nebraska, southward to Utah and western Iowa.

In the study area *obscura* has been collected in the southern eroded portion of the mixed prairie from southeastern Alberta to southwestern Manitoba (Map 34).

Genus *Orphulella* Giglio-Tos

Orphulella Giglio-Tos, 1894, Boll. Mus. Zool. Anat. Comp. Torino 9: 8.

Genotype: *Acrydium punctatum* DeGeer.

Antenna slender, not noticeably flattened. Face slanted; lateral foveolae slender and shallow, not visible from above; depression of vertex without a carina (Fig. 114). Lateral carinae of pronotum evident throughout, nearly parallel to definitely constricted; median carina strong throughout, cut by one sulcus; posterior margin of pronotum obtuse; prosternum without a tubercle. Tegmina extending to apices of hind femora, slender; hind wings clear. Inner spurs of hind tibia approximately equal.

Orphulella pelidna pelidna (Burmeister)

Gomphocerus pelidnus Burmeister, 1838, Handbook Ent. 2: 650.

A grey or somewhat greenish species with black markings. Lateral carinae of pronotum somewhat constricted in front and not complete at this constriction (Fig. 114); lateral foveolae of head narrow, generally closed below; tegmina extending just beyond tip of hind femora. Tip of male aedeagus produced as a nipple; base of lateral basivalvular sclerite of ovipositor black. Length 18-25 mm.

Distribution.—Two subspecies of *pelidna* are recognized at present. *O. pelidna desereta* Scudder is known from Utah, Colorado, Arizona, Idaho, and Washington. *O. pelidna pelidna* (Burmeister) occurs extensively over eastern United States and Canada westward to Alberta; but only locally along the eastern base of the Rocky Mountains in Colorado, New Mexico, and Montana.

In the study area *pelidna* is a common species in wetter pastures of Manitoba. In Saskatchewan and Alberta it is confined to the margins of alkaline sloughs, and therefore quite local in distribution. It is found in suitable places throughout the grasslands (Map 33).

Orphulella speciosa (Scudder)

Stenobothrus speciosus Scudder, 1862, Boston J. Nat. Hist. 7: 458.

A green to brownish-yellow or grey species. Side of head behind eye and upper part of pronotum outside lateral carina black; tegmen with a central line of spots which are more conspicuous in the female. Lateral foveolae of head not closed below; lateral carinae of pronotum ridge-like throughout and evenly curved, cut only by principal sulcus (Fig. 115). Tegmina usually not extending to tip of hind femur, but rarely longer. Tip of male aedeagus pointed but not produced; lateral basivalvular sclerite of ovipositor colourless. Length 16-22 mm.

The species is a grass-feeder.

Distribution.—From Ontario southward to North Carolina, Alabama, Louisiana, and Oklahoma westward to Manitoba, the Dakotas, Nebraska, and Kansas; taken locally in Wyoming and Montana.

In the study area *speciosa* is a common species of dry sandier land on hill-sides and in pastures in southern Manitoba and southeastern Saskatchewan (Map 34).

Genus *Phlibostroma* Scudder

Phlibostroma Scudder, 1875, Proc. Boston Soc. Nat. Hist. 17: 516.

Genotype: *Stenobothrus quadrimaculatus* Thomas.

Antenna slender, slightly flattened toward base. Face somewhat slanting; lateral foveolae large, very shallow, and not visible from above; depression of vertex shallow, with a faint median carina. Lateral carinae of pronotum weak behind, strongly constricted in front (Fig. 100); median carina strong, cut by one sulcus; posterior margin of pronotum obtuse behind; prosternum without a tubercle. Tegmina generally not reaching apex of abdomen; hind wings clear. Inner spurs of hind tibia slightly unequal.

***Phlibostroma quadrimaculatum* (Thomas)**

Stenobothrus quadrimaculatus Thomas, 1871, Prelim. Rept. U.S. Geol. Surv. Wyoming and Terr. 2: 280.

A yellowish-brown or green species, with a black stripe behind each eye, and narrow stripes or blotches on pronotum. Tegmina with four or five large, irregular, dark blotches on median area. Hind femur with partial bands in male; hind tibia yellow to orange. Length 14-25 mm.

The species feeds on several species of grasses.

Distribution.—From the central Dakotas, Manitoba, Nebraska, Kansas, and southwestern Oklahoma to Montana, Wyoming, Colorado, New Mexico, and Alberta.

In the study area *quadrimaculatum* is fairly common on the dry mixed-prairies of southern Alberta and southwestern Saskatchewan. It has not been collected in eastern Saskatchewan and is known only from Carberry and Lyleton in southwestern Manitoba (Map 35).

Genus *Pseudopomala* Morse

Pseudopomala Morse, 1896, Psyche 7: 325.

Antenna conspicuously flattened toward base, triangular in cross-section. Face strongly slanting; lateral foveolae of head absent; depression of vertex with a strong carina. Lateral carinae of pronotum strong throughout, approximately parallel (Fig. 116); median carina strong, superficially cut by principal sulcus behind the middle; prosternum with a low tubercle; posterior margin of pronotum truncate. Tegmina usually short and the veins crowded.

***Pseudopomala brachyptera* (Scudder)**

Opomala brachyptera Scudder, 1862, Boston J. Nat. Hist. 7: 454.

1 A slender, grey or brownish-grey species with short tegmina. Body greyish-yellow, usually with paler lines on dorsal surface of head, along pronotal carinae, and on female tegmina. Tegmina extending to third or fourth abdominal segment, acute in female. Femur entirely pale; hind tibia brownish-yellow. Length 25-35 mm.

Distribution.—From New England to British Columbia, southward as far as New Jersey, Pennsylvania, Michigan, Iowa, Nebraska, Montana, Wyoming, and Utah.

In the study area *brachyptera* has been collected only in one small coulee at Onefour in southeastern Alberta (Map 35).

Genus *Psoleossa* Scudder

Psoleossa Scudder, 1875, Proc. Boston Soc. Nat. Hist. 17: 512.

Genotype: *Psoleossa texana* Scudder.

Antenna slender, slightly flattened toward base. Face a little slanted; lateral foveolae rectangular, conspicuous, and visible from above; depression of vertex deep, without a median carina. Lateral carinae of pronotum weak behind, strongly constricted in front of centre (Fig. 101); median carina strong, cut by one sulcus; posterior margin of pronotum obtuse; prosternum without a tubercle. Tegmina long; hind wings clear. Inner spurs of hind tibia unequal.

***Psoloessa delicatula delicatula* (Scudder)**

Scyllina delicatula Scudder, 1876, Bull. Geol. Surv. Terr. 2: 263.

A dark grey to green species with conspicuous, black markings behind eye, on sides of pronotum, and on posterior portion of pronotum next lateral carina. Tegmen mostly shining, brownish-grey, and with a row of four to six rectangular black spots on median line. Hind femur with partial black bands dorsally; hind tibia yellow, brown, or pale bluish. Length 16-18 mm.

The subspecies feeds on several species of grasses and sedges such as *Stipa* spp., *Carex* spp., *Agropyron* spp., or *Festuca* spp. *Phlox hoodii* Richards is also readily eaten.

Distribution.—Two subspecies of *delicatula* are recognized at present. *P. delicatula buckelli* Rehn is known from southern British Columbia, Washington, and Oregon. *P. delicatula delicatula* (Scudder) is known from Montana, the Great Plains, Great Basin, Colorado, Wyoming, British Columbia, Alberta, Saskatchewan, Manitoba, North Dakota, Nebraska, and Kansas.

In the study area *delicatula* is widely distributed throughout the grasslands of the entire southern part from Calgary and Wainwright, Alta., to Morden, Man.

FAMILY TETRIGIDAE

Members of the family are very variable in size, in colour, in the length of the pronotum and wings, and in habitat preference. Each of the species in the study area contains long and short-winger variants, both elements together in one population. Both the morphological characteristics and the colour patterns appear to have a genetic basis (Nabours, 1947), which results in many discrete types without intermediates.

The species usually hibernate as adults, or as late-stage nymphs. The eggs are laid in May and June, the nymphs maturing by fall. Adults may be collected throughout the year, indicating a rather long individual life, and a not-too-rigid time table for life history.

Only three species belonging to two genera have been collected in the Prairie Provinces*.

Key to Species

1. Antenna with 20-22 segments; front margin of pronotum obtusely produced forward between eyes; median carina of face extending over vertex as an unbroken arc, not angulate (Fig. 110); upper surface yellowish-grey to brownish, the sides black; tegmina with a yellow spot near tip; eastern Manitoba *Tettigidea lateralis parvipennis* (Harris)
- Antenna with 12-14 segments; front margin of pronotum not produced; median carina of face meeting median carina of front at an angle; upper surface white to black, usually with a pattern of black markings 2
2. Front of vertex, viewed from above, obtusely angulate; the median carina not projecting beyond sides; median carina of face, viewed in profile, nearly straight above antenna (Fig. 108); widespread *Tetrix subulata* (Linnaeus)
- Front of vertex, viewed from above, convex or rounded, the median carina distinctly projecting as a small tooth beyond sides; median carina of face, viewed from the side, distinctly concave above antenna (Fig. 109); widespread *Tetrix ornata* (Say)

Genus *Tetrix* Latreille

Tetrix Latreille, 1802, Hist. Nat. Crust. Ins. 3: 384.

Acrydium of authors, not *Acrydium* Geoffroy (1764).

Genotype: *Gryllus subulatus* Linnaeus.

*Rehn and Grant (1956, Trans. Amer. Ent. Soc. 82: 117-145) report *Tetrix arenosa angusta* (Hancock) from Aweine, Man. The subspecies differs from *T. ornata* (Say) as follows: median carina of pronotum indistinct; dorsal surface of pronotum flat or nearly so; dorsal surface evenly and finely granulate; vertex flatter, parallel-sided and less projecting than in *ornata*. I have not seen the species from this area.

The genus is readily recognized by the more or less produced, broad vertex, the short, nearly truncate front margin of pronotum, the comparatively low median carina of pronotum, and by the deep notches of lateral lobes of pronotum.

***Tetrix subulata* (Linnaeus)**

Gryllus subulatus Linnaeus, 1761, Fauna Suecica, ed. 2: 236.

Distribution.—Europe and boreal America southward to Pennsylvania, northern Illinois, Iowa, and Nebraska; and in the west to Utah, Colorado, New Mexico, and Arizona.

A very common inhabitant of wet pastures and lake margins throughout the study area and sometimes found in great numbers.

***Tetrix ornata* (Say)**

Acrydium ornatum Say, 1824, Amer. Ent. 1: 5.

Tettigidea acadica Scudder, 1875, Dawson Rept. Geol. 49th Parallel: 345.

There appears to be no valid reason for maintaining the two species *ornata* Say and *acadica* Scudder, although Hebard has kept them separated in all his summaries. Hebard's key characters (1936) are as follows:—

"Size larger, form more robust. Pronotum showing trace of tectation. Fastigium often showing very weak indication of triangular production

Size smaller, form less robust. Pronotum showing no trace of tectation. Fastigium normally showing less production

The weak characters used by Hebard to separate the species often break down in one population. In general, the *ornata* type (smaller, more ornate) predominates on open, sandy plains, while the *acadica* type (larger, darker) predominates in the northern parklands and in the forest. Both types occur together in both open and forest habitats together with larger *ornata* and smaller *acadica*. The colour patterns may be separated into a great number of discrete types with very little blending.

Distribution.—Alberta to Ontario, southward to North Carolina, Mississippi, Missouri, and Kansas. West of that region it extends southward along the eastern slopes of the mountains to New Mexico and Texas.

The species is sometimes very abundant in dry pastures on the edge of forested or parkland areas, and along grassy paths among the trees. It is widely distributed in the study area.

Genus *Tettigidea* Scudder

Tettigidea Scudder, 1862, Boston J. Nat. Hist. 7: 476.

Genotype: *Acrydium laterale* Say.

As only one species of this genus has been collected in the study area it is easily recognized by the subfamily characters given in the key.

***Tettigidea lateralis parvipennis* (Harris)**

Acrydium parvipennis Harris, 1833, Hitchcock's Rept. Geol. Mass. 1: 583.

The division of this species into two weak subspecies has been questioned by Hebard (1932). In Iowa intermediates between the two show gradual rather than discontinuous differences regardless of the collecting areas, and Froeschner (1954) did not separate them.

All specimens collected in southeastern Manitoba appear referable to the subspecies *parvipennis*. In a series collected at Reynolds, Man. in 1953, the short-winged variant outnumbered the long-winged.

Distribution.—Two subspecies of *lateralis* have been recognized. *T. lateralis lateralis* (Say) occurs in eastern United States south of southern Indiana and Illinois as far as Florida, Oklahoma, New Mexico, and Cuba. *T. lateralis parvi-*

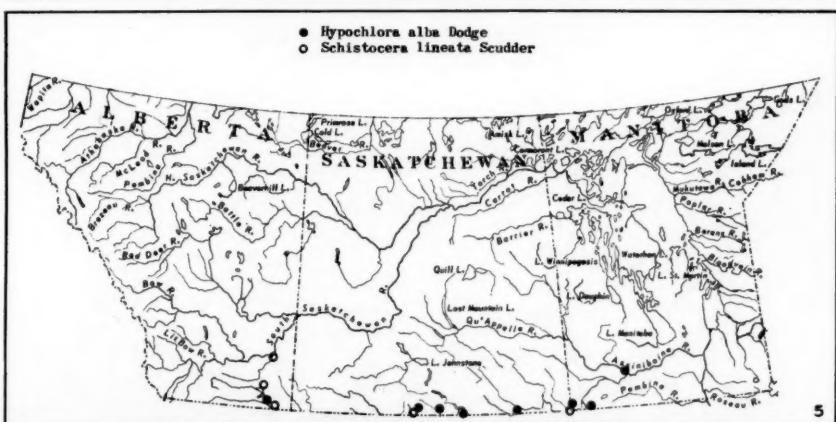
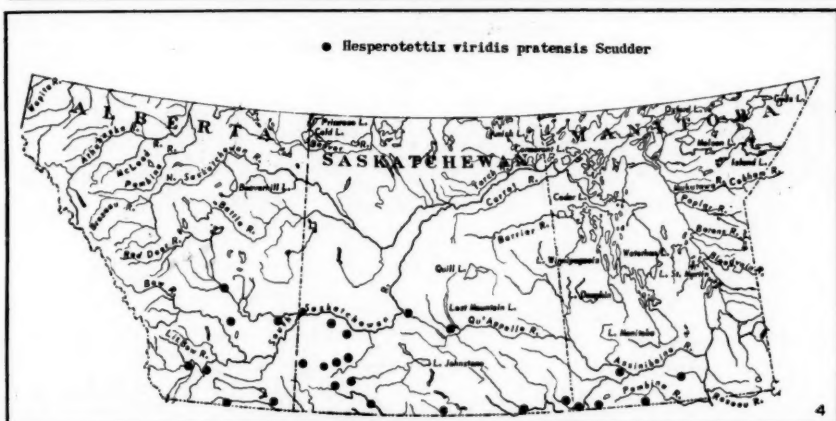
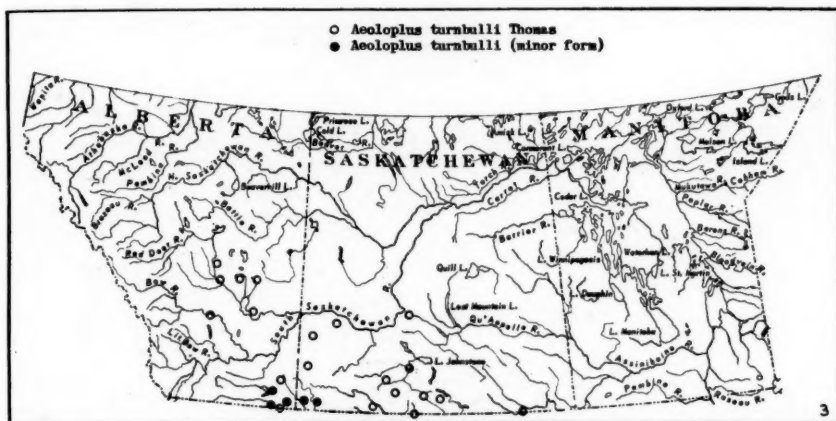
pennis (Harris) is known from Ontario, Quebec, and New England westward to Minnesota, Iowa, and eastern Manitoba.

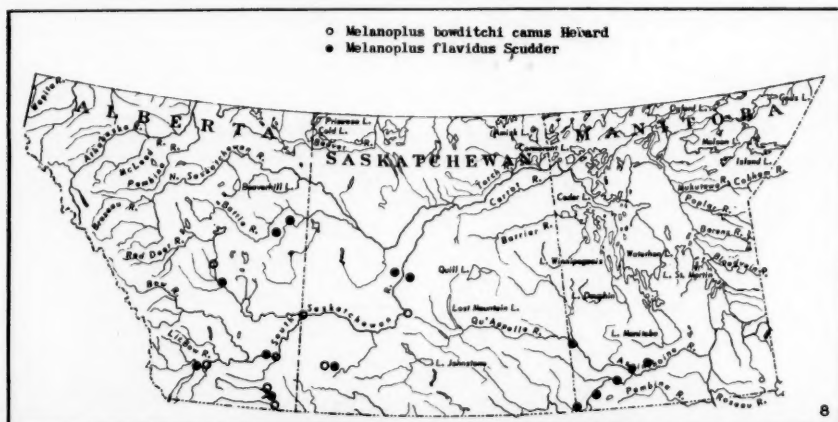
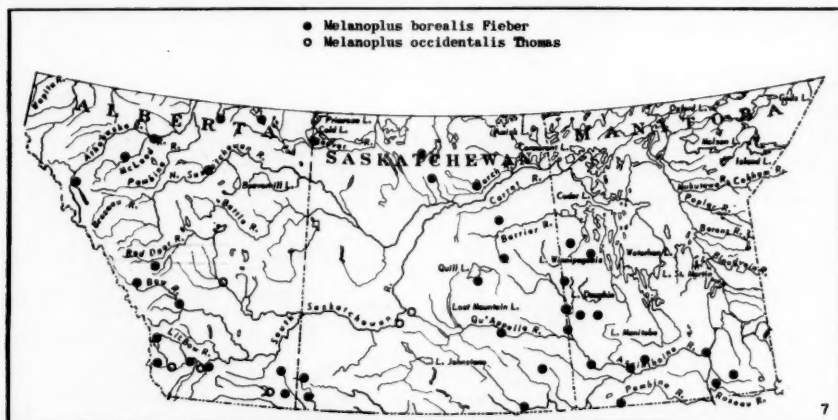
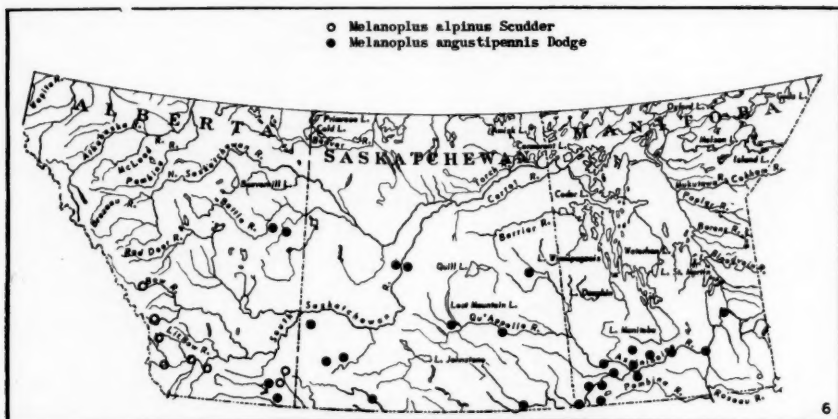
In the study area *parvipennis* is rather abundant in eastern Manitoba south and east of Winnipeg to the Minnesota boundary. It occurs with *Tetrix subulata* in wet grassy meadows.

REFERENCES

- Anderson, N. L., and J. C. Wright. 1952. Grasshopper investigations on Montana range lands. Montana Agr. Expt. Sta. Tech. Bull. 486: 46 pp.
- Bird, R. D. 1930. Biotic communities of the aspen parkland of central Canada. Ecology 11: 356-442.
- Blatchley, W. S. 1920. Orthoptera of northeastern America. The Nature Publishing Co., Indianapolis. 784 pp.
- Brett, C. H. 1947. Interrelated effects of food, temperature, and humidity on the development of the lesser migratory grasshopper, *Melanoplus mexicanus mexicanus* (Saussure) (Orthoptera). Okla. Agr. Expt. Sta. Tech. Bull. T-26. 50 pp.
- Buckell, E. R. 1922. A list of the Orthoptera and Dermaptera recorded from British Columbia prior to the year 1922, with annotations. Proc. Ent. Soc. British Columbia 20: 12-41.
- Caudell, A. N. 1908. Notes on some western Orthoptera, with descriptions of new species. Proc. U.S. Natl. Mus. 34: 71-81.
- Clements, F. E., and V. E. Shelford. 1939. Bio-ecology. John Wiley and Sons Inc., Chicago. 425 & vi pp.
- Coupland, R. T. 1950. Ecology of mixed prairie in Canada. Ecol. Monogr. 20: 271-315.
- Coupland, R. T., and T. C. Brayshaw. 1953. The fescue grassland in Saskatchewan. Ecology 34: 386-405.
- Criddle, N. 1933. Notes on the habits of injurious grasshoppers in Manitoba. Can. Ent. 65: 97-102.
- Criddle, N. 1933. Studies in the biology of North American Acrididae. Development and habits. Proc. World's Grain Exhib. and Conf., Canada 2: 474-494.
- Ellis, J. H. 1938. The soils of Manitoba. Manitoba Economic Survey Board. 112 pp.
- Faure, J. C. 1933. The phases of the Rocky Mountain locust, *Melanoplus mexicanus* (Saussure). J. Econ. Ent. 26: 706-718.
- Froeschner, R. C. 1954. The grasshoppers and other Orthoptera of Iowa. Iowa State Coll. J. Sci. 29: 163-354.
- Fulton, B. B. 1930. Notes on Oregon Orthoptera with descriptions of new species and races. Ann. Ent. Soc. America 23: 611-641.
- Halliday, W. E. D. 1937. A forest classification for Canada. Canada Dept. Mines and Resources, For. Serv. Bull. 89. 50 pp.
- Handford, R. H. 1946. The identification of the nymphs of the genus *Melanoplus* of Manitoba and adjacent areas. Sci. Agr. 26: 147-180.
- Hebard, M. 1925. The Orthoptera of South Dakota. Proc. Acad. Nat. Sci. Philadelphia 77: 33-155.
- Hebard, M. 1928. The Orthoptera of Montana. Proc. Acad. Nat. Sci. Philadelphia 80: 211-305.
- Hebard, M. 1930. The Orthoptera of Alberta. Proc. Acad. Nat. Sci. Philadelphia 82: 377-403.
- Hebard, M. 1932. The Orthoptera of Minnesota. Univ. Minn. Agr. Expt. Sta. Tech. Bull. 85. 61 pp.
- Hebard, M. 1936. The Orthoptera of North Dakota. N.D. Agr. Coll. Expt. Sta. Tech. Bull. 284. 66 pp.
- Isely, G. B. 1936. Flight stridulation in American acridians (Orthoptera, Acrididae). Ent. News 47: 199-205.
- Isely, G. B. 1938. Relations of Texas Acrididae to plants and soils. Ecol. Monogr. 8: 551-604.
- Isely, G. B. 1944. Correlation between mandibular morphology and food specificity in grasshoppers. Ann. Ent. Soc. America 37: 47-67.
- Gurney, A. B., and A. R. Brooks. In preparation. A revision of the *Melanoplus mexicanus* group.
- Key, K. H. L. 1951. A critique on the phase theory of locusts. Quart. Rev. Biol. 25: 363-407.

- Kirby, W. F. 1910. A synonymic catalogue of Orthoptera, vol. 3. Orthoptera, Saltatoria. Taylor and Francis, London. 674 & vii pp.
- Mayr, E., E. G. Linsley, and R. L. Usinger. 1953. Methods and principles of systematic zoology. McGraw-Hill Book Company, Toronto. 328 pp.
- Mitchell, J., H. C. Moss, and J. S. Clayton. 1944. Soil survey of southern Saskatchewan from township 1 to 48 inclusive. University of Saskatchewan, Coll. Agr. soil survey report no. 12. Saskatoon, Sask. 259 & viii pp.
- Mitchell, J., H. C. Moss, and J. S. Clayton. 1950. Soil survey of Saskatchewan covering the agriculturally settled areas north of township 48. University of Saskatchewan, Coll. Agr. soil survey report no. 13. Saskatoon, Sask. 241 & viii pp.
- Moss, E. H. 1955. The vegetation of Alberta. The Botanical Review 21: 493-567.
- Nabours, R. K. 1947. The grouse locust. J. Kansas Ent. Soc. 20: 127-141.
- Newton, R. C., and C. O. Esselbaugh. 1952. Studies of range grasshoppers in eastern Wyoming in 1951. U.S. Dept. Agr. Spec. Rept. D 24. 42 pp.
- Odynsky, W. 1945. Soil zones of Alberta. Univ. Alta., Dept. Ext. map.
- Pfadt, R. E. 1949. Food-plants, distribution, and abundance of the big-headed grasshopper, *Aulocara elliotti* (Thos.). J. Kansas Ent. Soc. 22: 69-74.
- Pfadt, R. E. 1949. Food plants as factors in the ecology of the lesser migratory grasshopper, *Melanoplus mexicanus* (Sauss.). Wyoming Agr. Expt. Sta. Bull. 290. 51 pp.
- Pickford, R. 1953. A two-year life-cycle in grasshoppers (Orthoptera: Acrididae) overwintering as eggs and nymphs. Can. Ent. 85: 9-14.
- Prescott, H. W. 1951. Grass feeders and forbs feeders. U.S. Dept. Agr. Spec. Rept. D 11. 5 pp.
- Putnam, L. G. 1954. Development in grasshopper research and control in Canada. Rept. 6th Commonwealth Ent. Conf., 1954: 133-137.
- Rehn, J. A. G. 1921. Descriptions of new and critical notes on previously known forms of North American Oedipodinae (Orthoptera: Acrididae). Trans. Amer. Ent. Soc. 47: 171-195.
- Roberts, H. R. 1941. A comparative study of the subfamilies of the Acrididae (Orthoptera), primarily on the basis of their phallic structures. Proc. Acad. Nat. Sci. Philadelphia 93: 201-246.
- Scudder, S. H. 1897. Revision of the orthopteran group Melanopli (Acrididae) with special reference to North American forms. Proc. U.S. Natl. Mus. 20. 421 pp.
- Scudder, S. H. 1901. Catalogue of the described Orthoptera of the United States and Canada. Proc. Davenport Acad. Nat. Sci. 8. 101 pp.
- Strickland, E. H. 1938. An annotated list of the Diptera (flies) of Alberta. Can. J. Res., D. 16: 175-219.
- Uvarov, B. P. 1921. A revision of the genus *Locusta*, with a new theory as to the periodicity and migrations of locusts. Bull. Ent. Res. 12: 135-163.
- Uvarov, B. P. 1928. Locusts and grasshoppers. Imperial Bureau of Entomology, London. 273 pp.
- Uvarov, B. P. 1943. The tribe Thrincini of the subfamily Pamphaginae, and the relationships of the acridid subfamilies. Trans. Roy. Ent. Soc. London 93: 1-73.
- Walker, E. M. 1902. A preliminary list of Acridiidae of Ontario. Can. Ent. 34: 251-258.
- Walker, E. M. 1910. The Orthoptera of Western Canada. Can. Ent. 42: 269-276, 293-300, 333-340, 351-356.
- White, R. M., and P. J. G. Rock. 1945. A contribution to the knowledge of the Acrididae of Alberta. Sci. Agr. 25: 577-596.

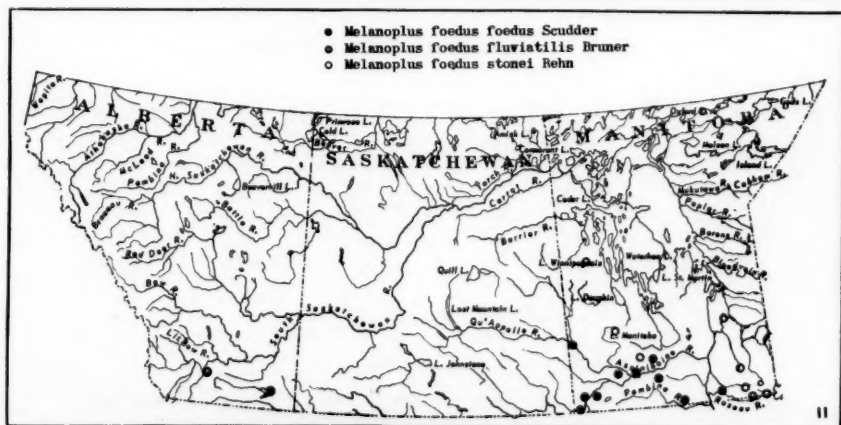
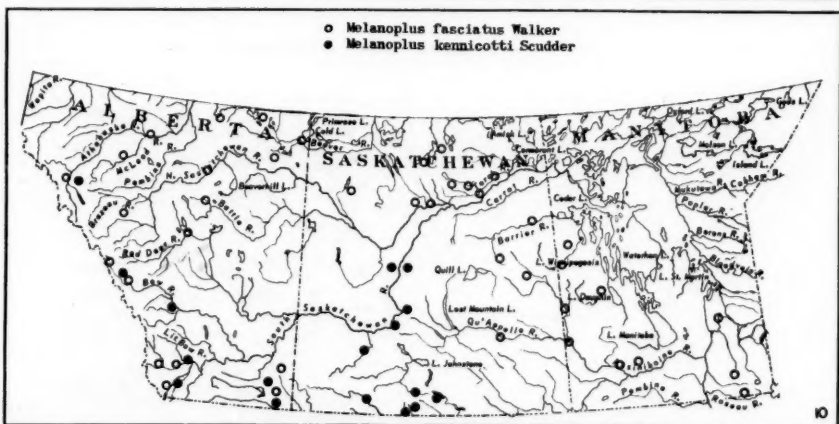
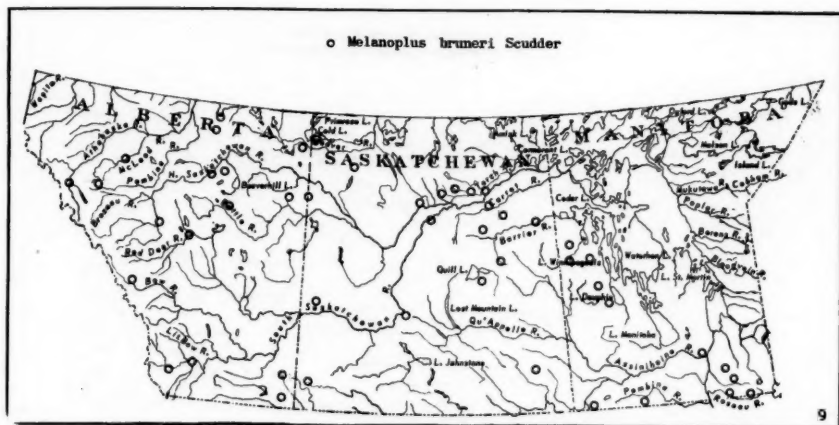
Map 3. Distribution of *Aeoloplus turnbulli*.Map 4. Distribution of *Hesperotettix viridis pratensis*.Map 5. Distributions of *Hypochlora alba* and *Schistocerca lineata*.

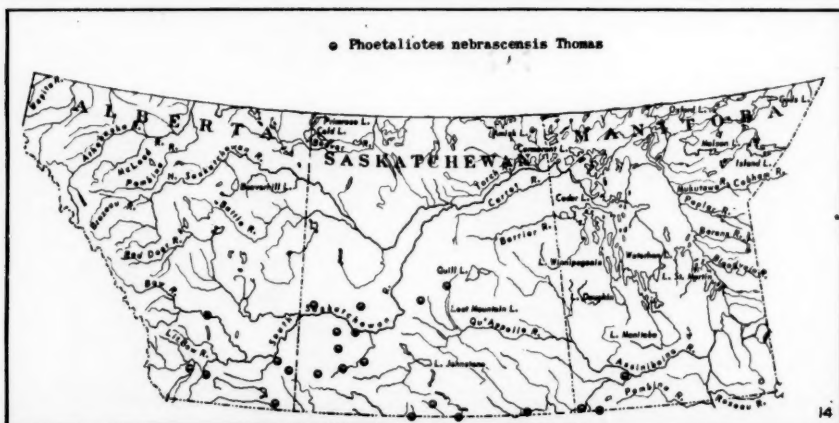
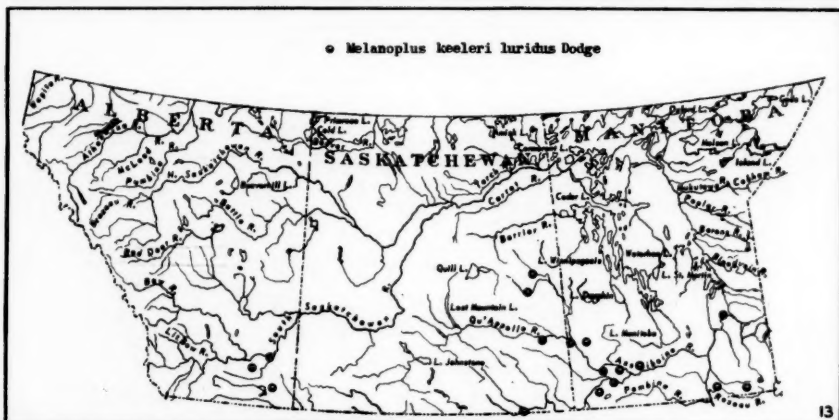
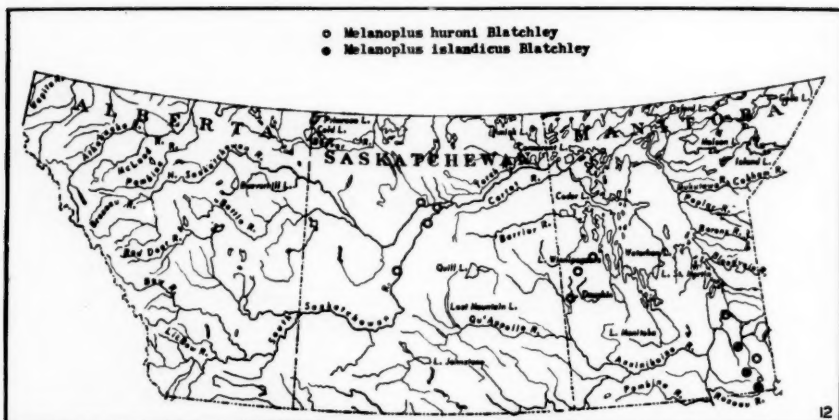


Map 6. Distributions of *Melanoplus alpinus* and *M. angustipennis*.

Map 7. Distributions of *Melanoplus borealis* and *M. occidentalis*.

Map 8. Distributions of *Melanoplus flavidus* and *M. bowditchi* canis.

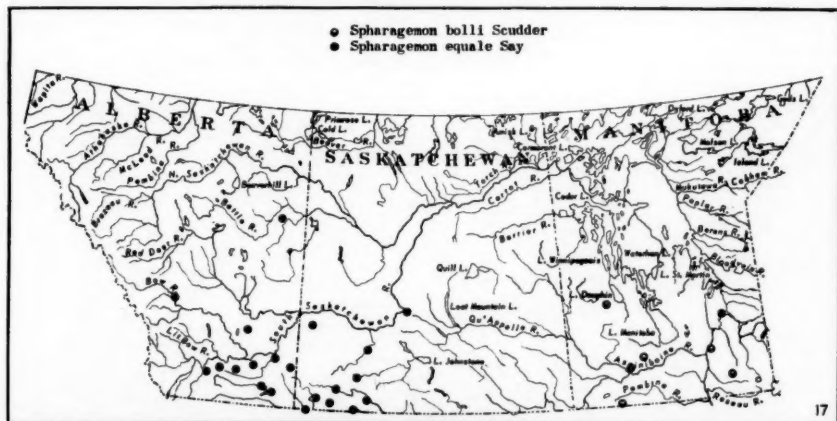
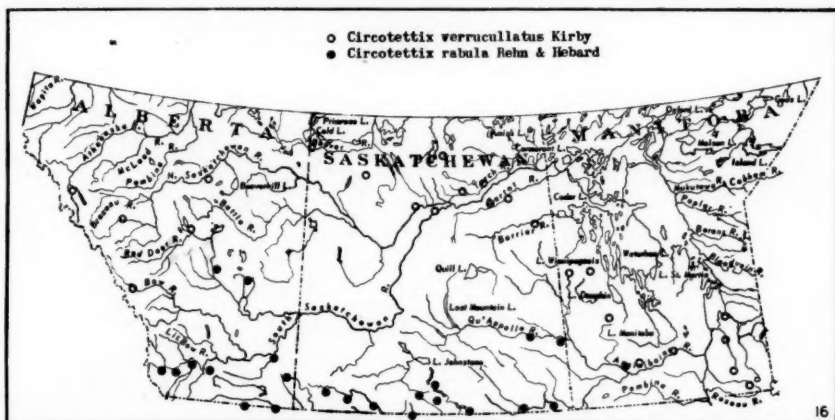
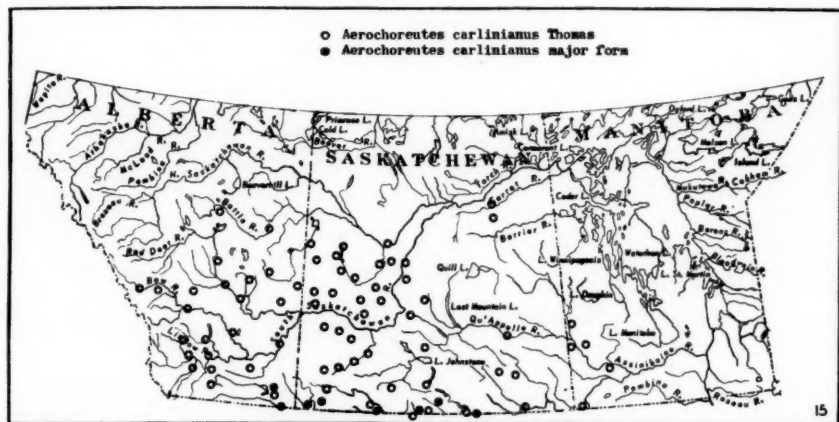
Map 9. Distribution of *Melanoplus bruneri*.Map 10. Distributions of *Melanoplus fasciatus* and *M. kennicotti*.Map 11. Distributions of *Melanoplus foedus* subspecies.

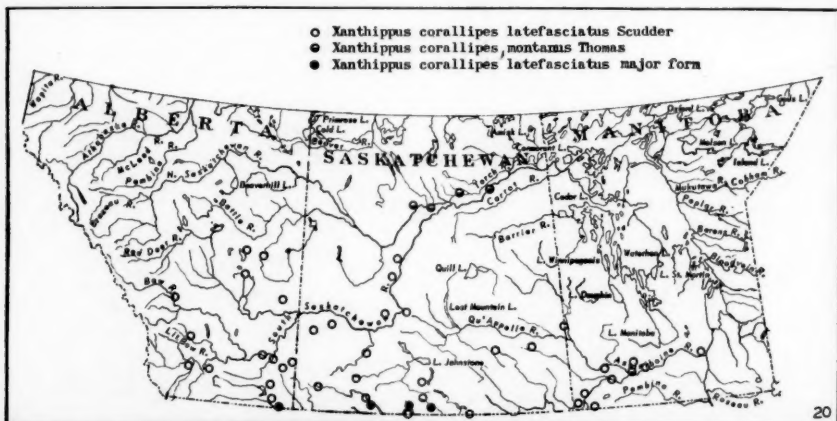
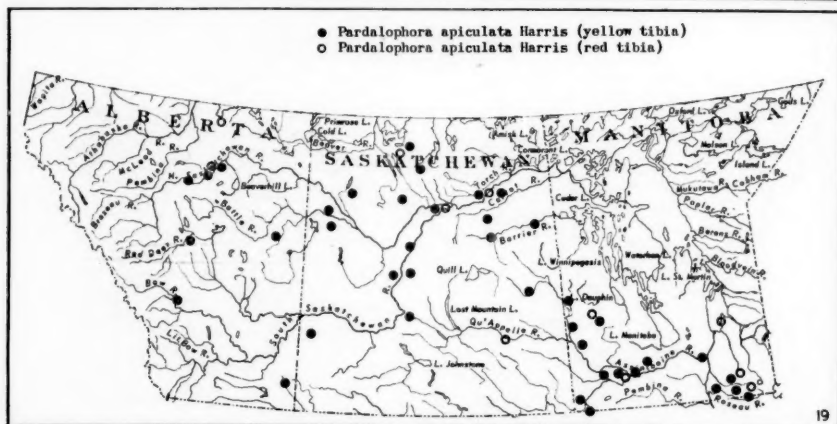
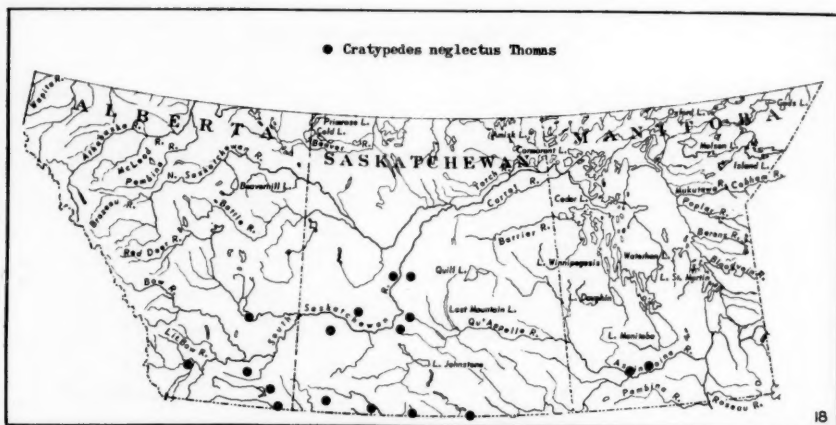


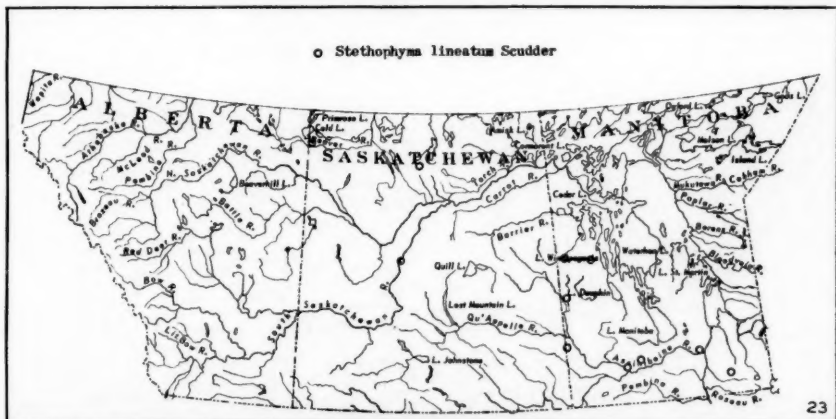
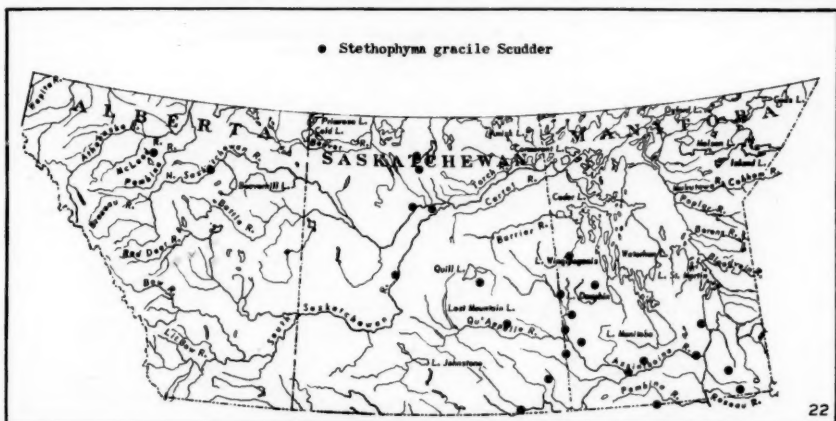
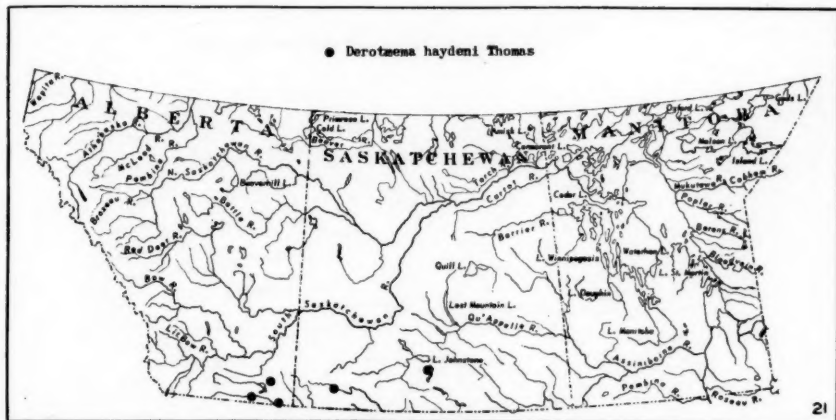
Map 12. Distributions of *Melanoplus huron* and *M. islandicus*.

Map 13. Distribution of *Melanoplus keeleri luridus*.

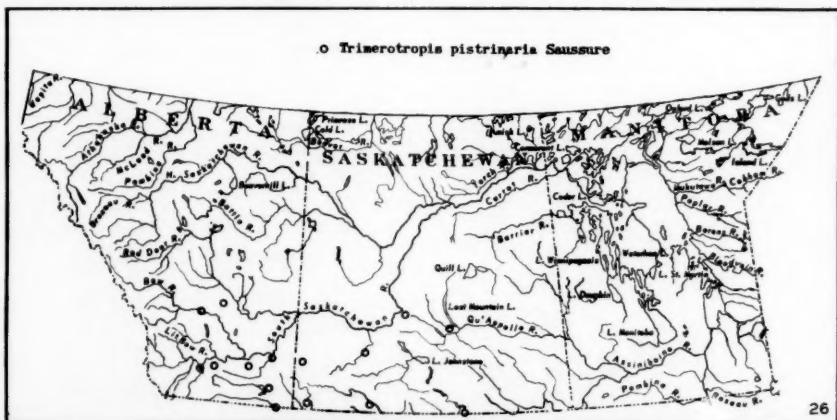
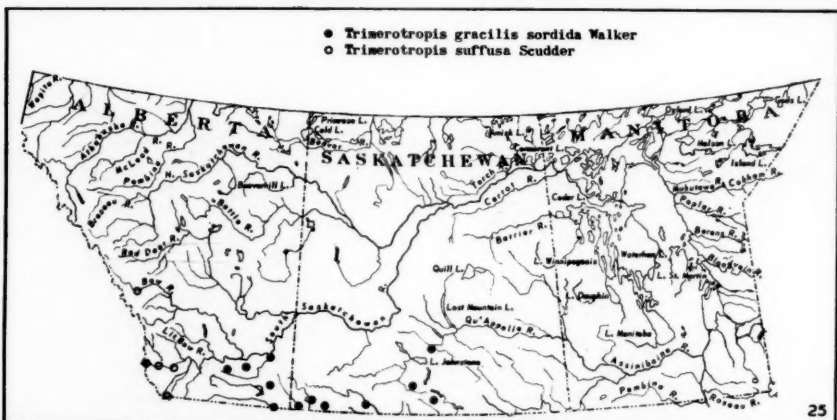
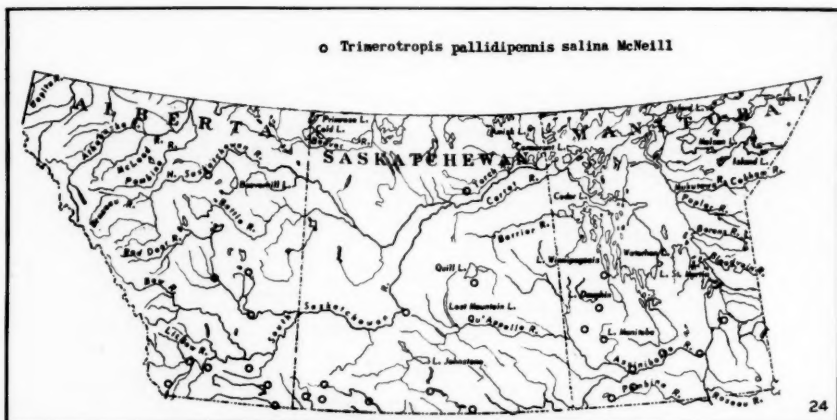
Map 14. Distribution of *Phoetaliotes nebrascensis*.

Map 15. Distribution of *Aerochoreutes carlinianus*.Map 16. Distributions of *Circotettix verruculatus* and *C. rabula*.Map 17. Distributions of *Spharagemon bolli* and *S. equale*.

Map 18. Distribution of *Cratypedes neglectus*.Map 19. Distribution of *Pardalophora apiculata*.Map 20. Distributions of *Xanthippus corallipes* subspecies.



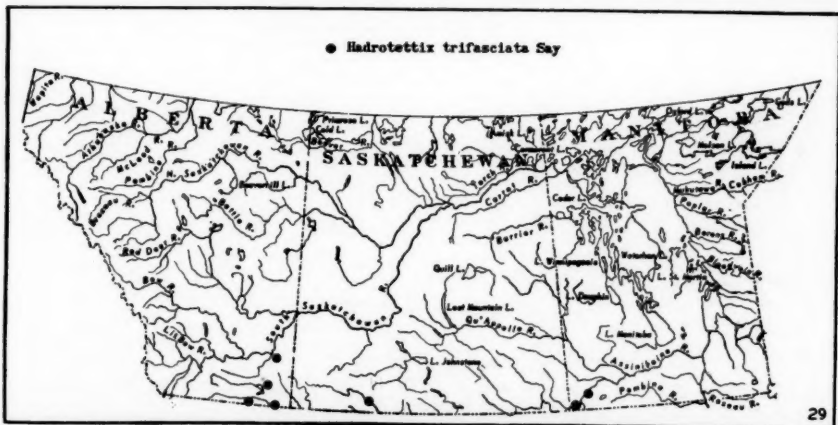
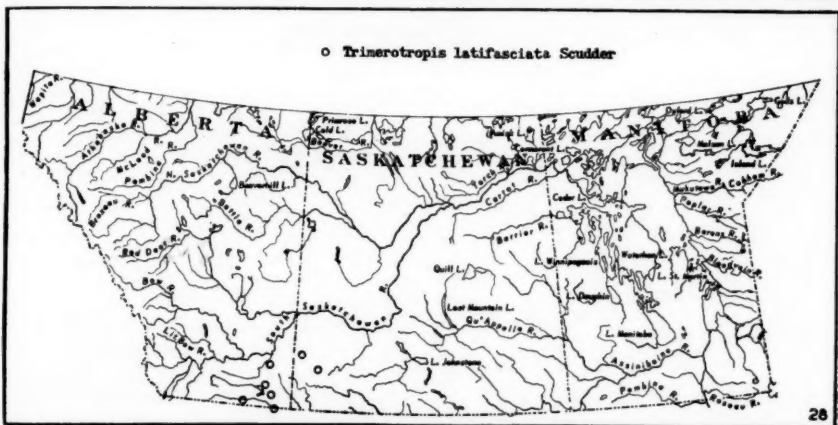
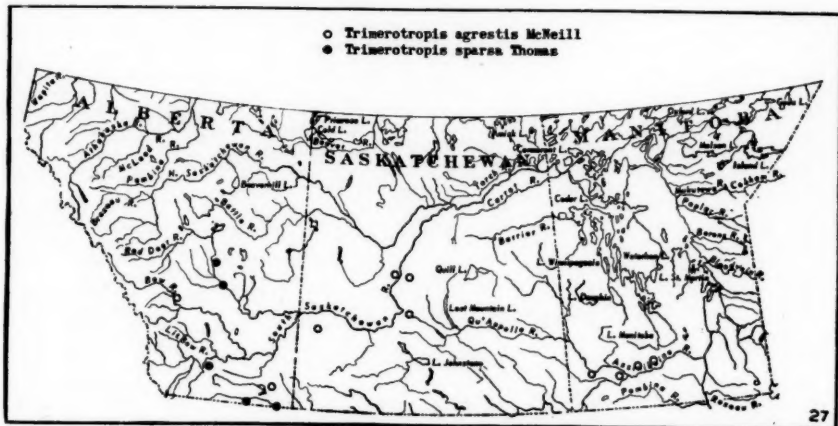
Map 21. Distribution of *Derotzena haydeni*.
 Map 22. Distribution of *Stethophyma gracile*.
 Map 23. Distribution of *Stethophyma lineatum*.

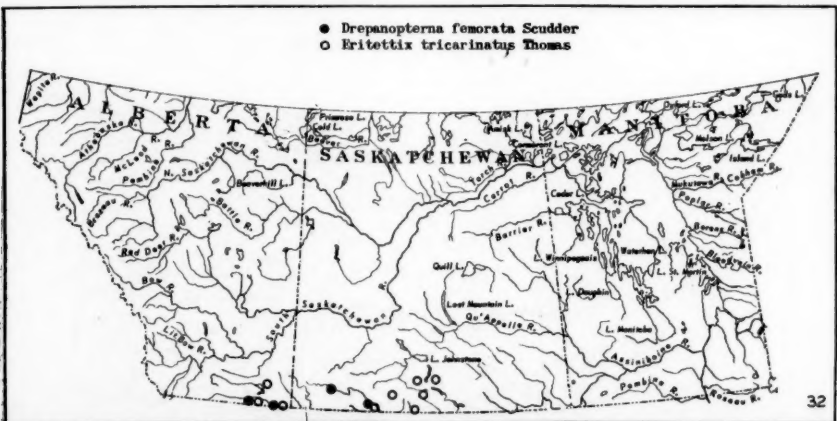
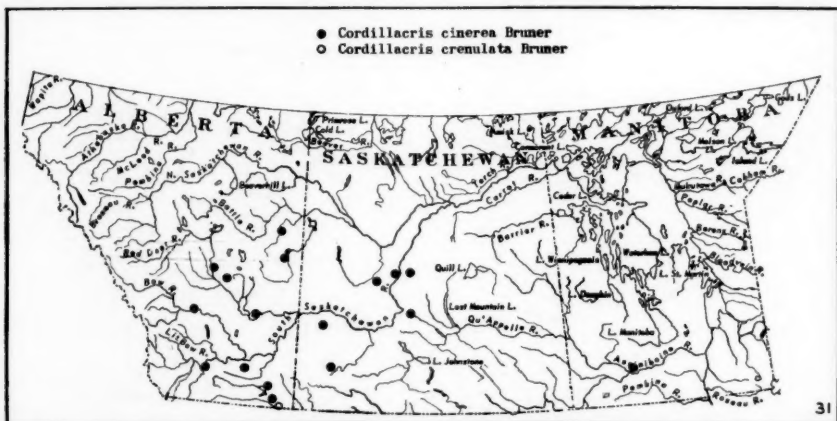
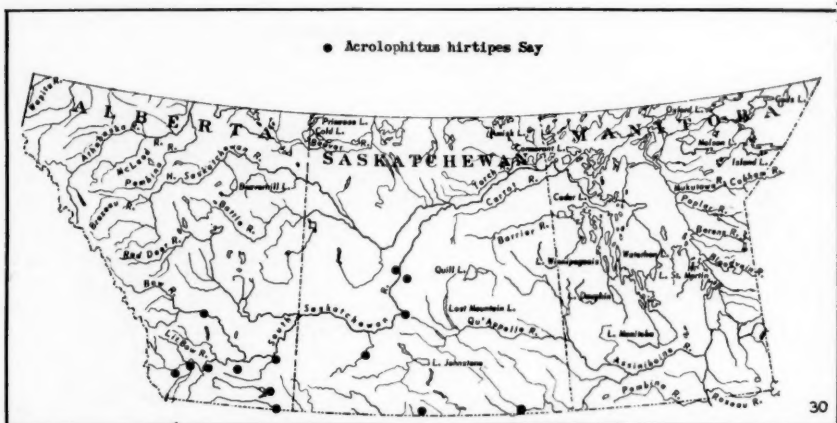


Map 24. Distribution of *Trimerotropis pallidipennis salina*.

Map 25. Distributions of *Trimerotropis suffusa* and *T. gracilis sordida*.

Map 26. Distribution of *Trimerotropis pistrinaria*.

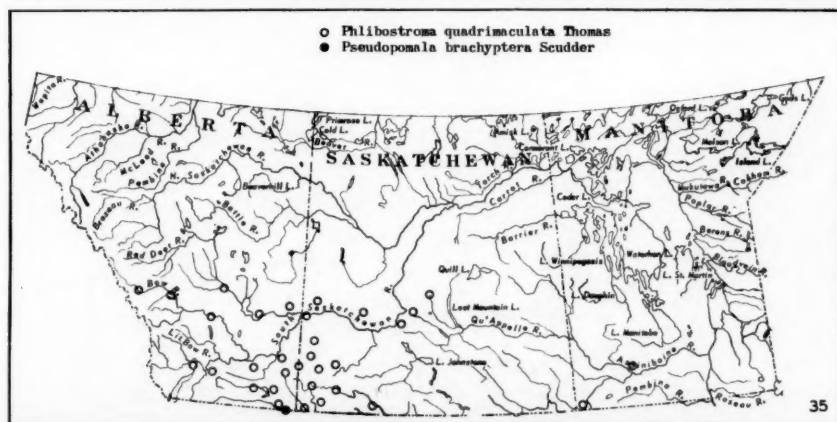
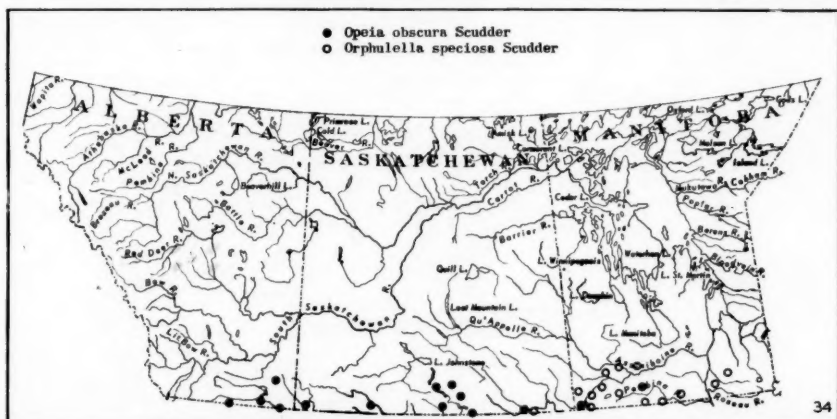
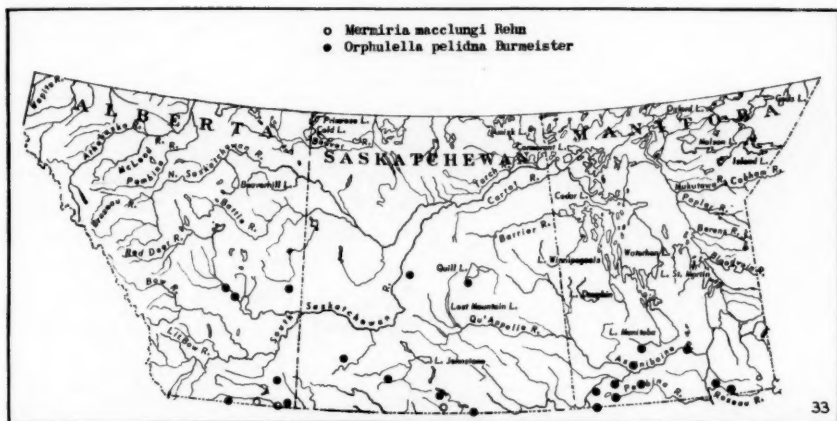
Map 27. Distributions of *Trimerotropis agrestis* and *T. sparsa*.Map 28. Distribution of *Trimerotropis latifasciata*.Map 29. Distribution of *Hadrotettix trifasciata*.



Map 30. Distribution of *Acrolophitus hirtipes*.

Map 31. Distributions of *Cordillacris occipitalis cinerea* and *C. crenulata*.

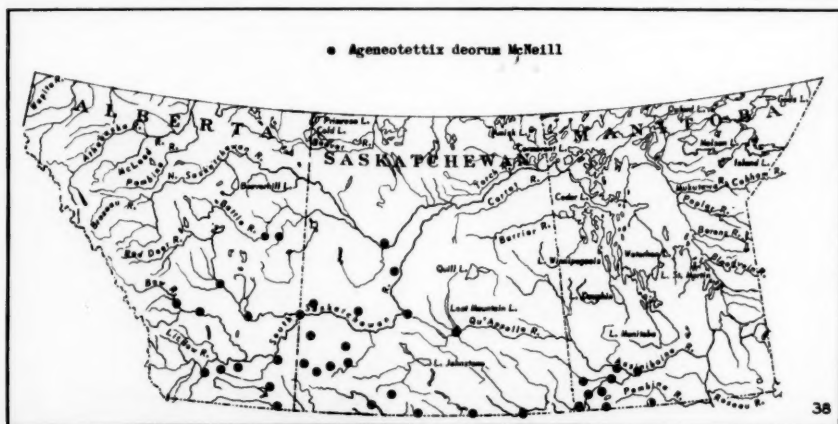
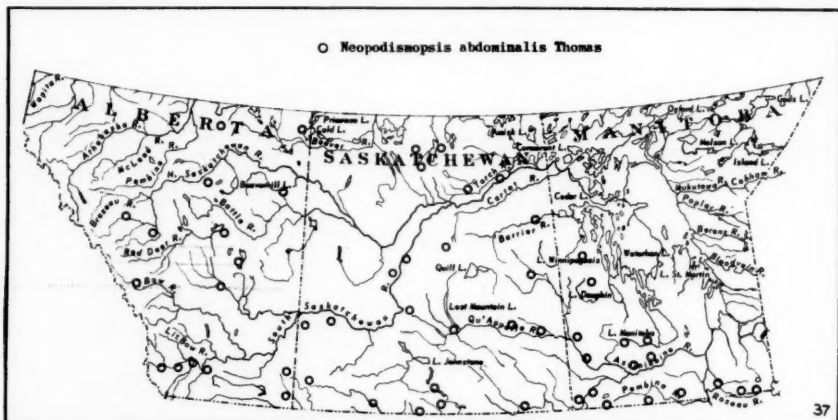
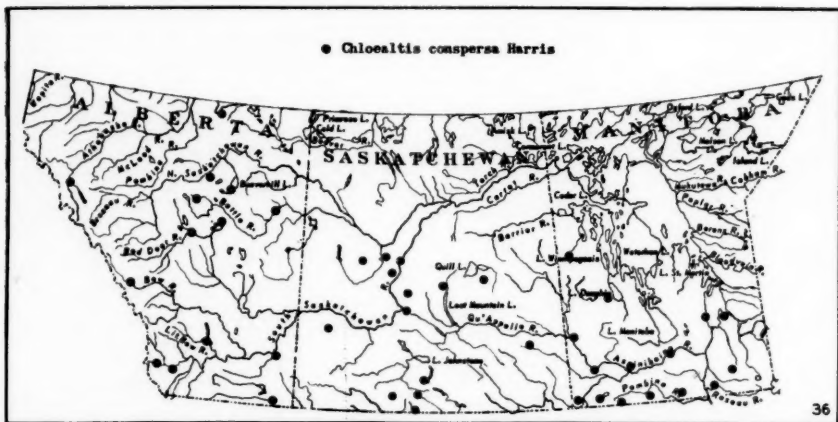
Map 32. Distributions of *Drepanopterna femorata* and *Eritettix simplex tricarlinatus*.



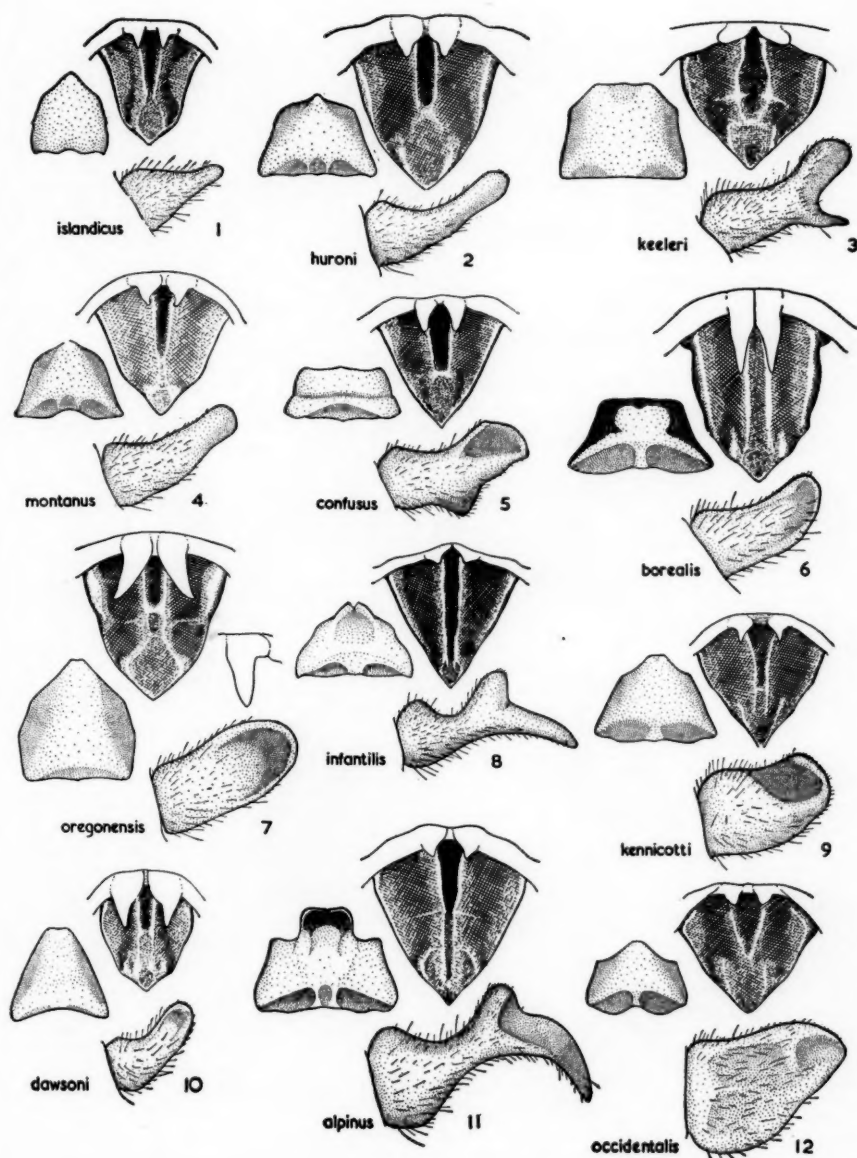
Map 33. Distributions of *Mermiria maculipennis macclungi* and *Orphulella pelidna*.

Map 34. Distributions of *Opeia obscura* and *Orphulella speciosa*.

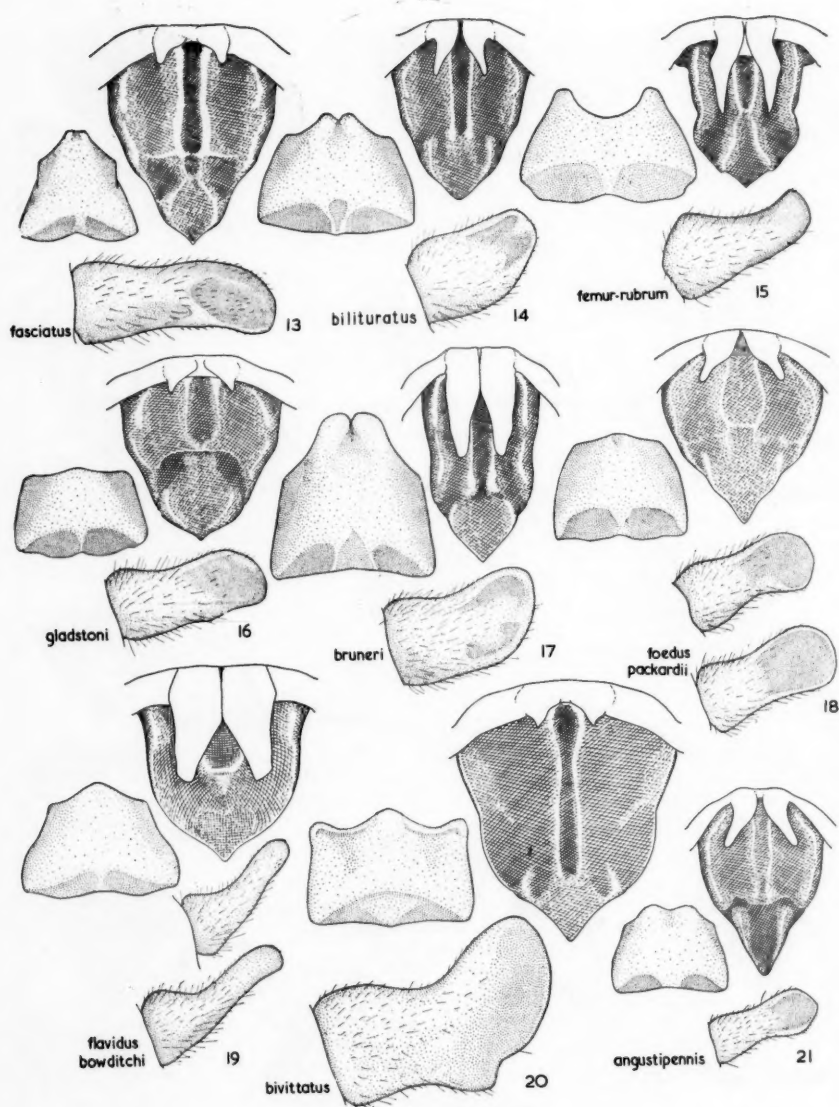
Map 35. Distributions of *Philibostroma quadrimaculatum* and *Pseudopomala brachyptera*.



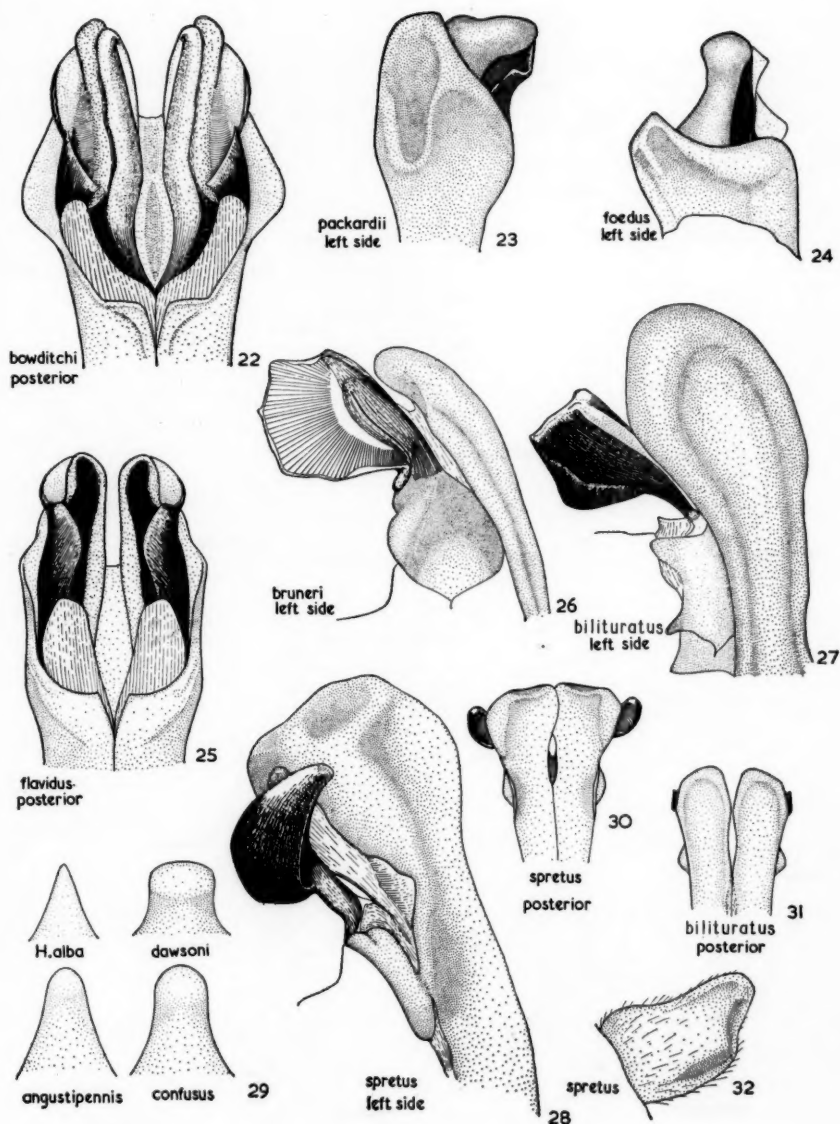
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 Map 38. Distribution of *Ageneotettix deorum*.



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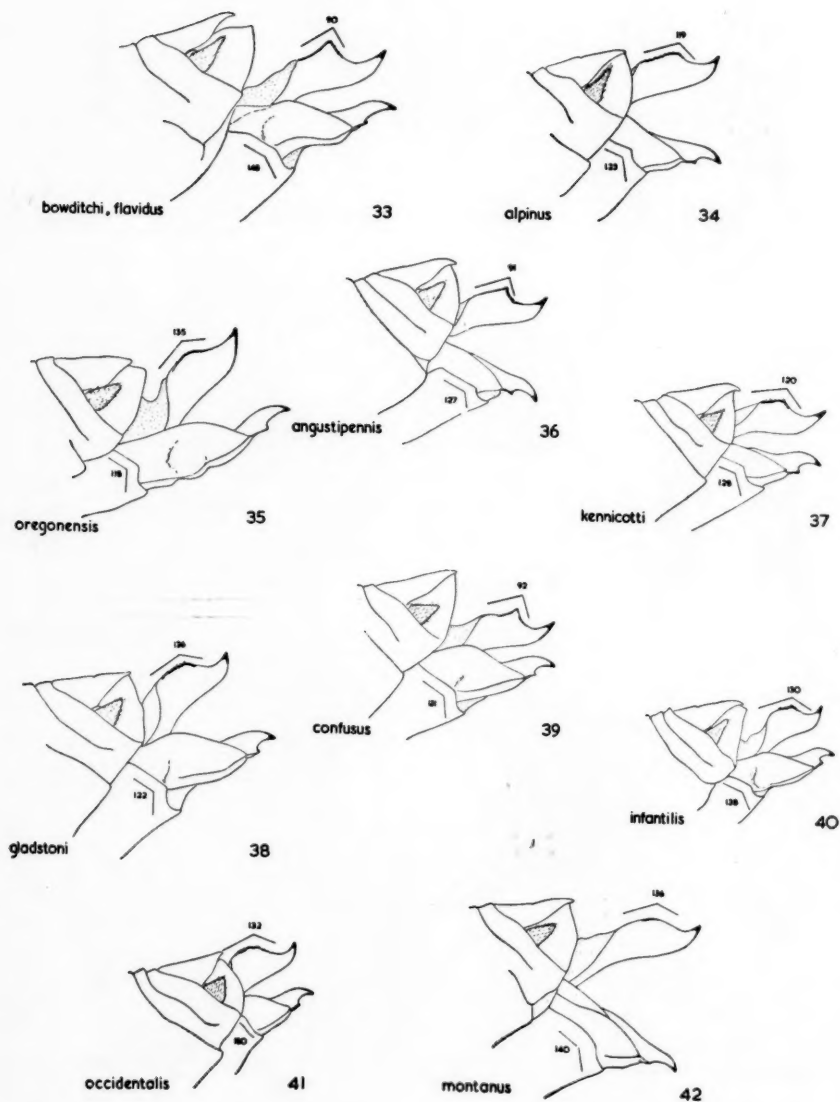
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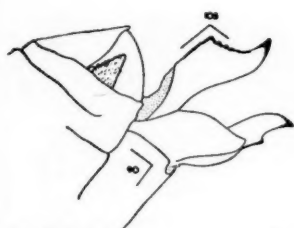
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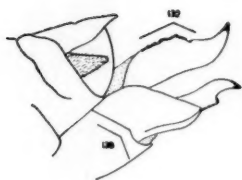
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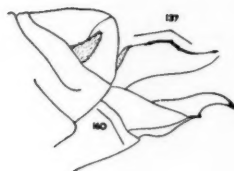
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*foedus, packardii*

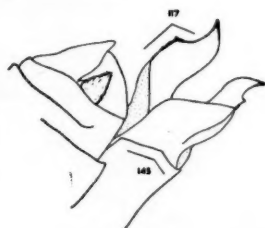
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*bruneri*

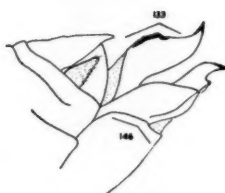
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*keeleri*

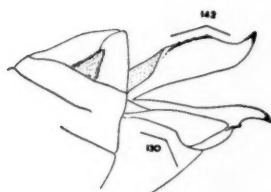
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*bilitturatus*

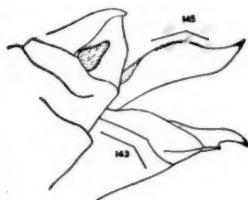
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*femur-rubrum*

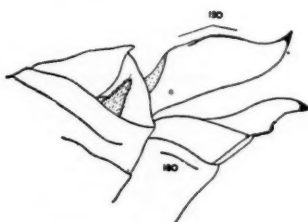
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*fasciatus*

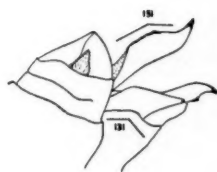
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*borealis*

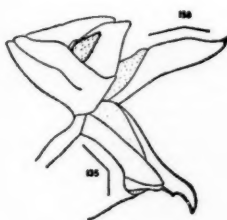
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*huroni*

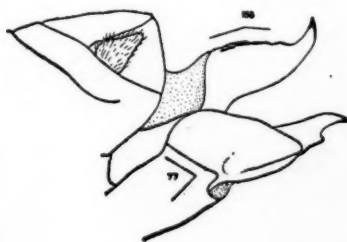
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*islandicus*

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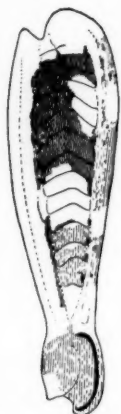
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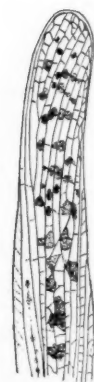
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spretus 60



bilituratus 61

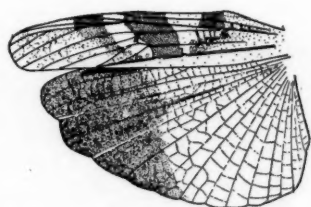


bilituratus 62

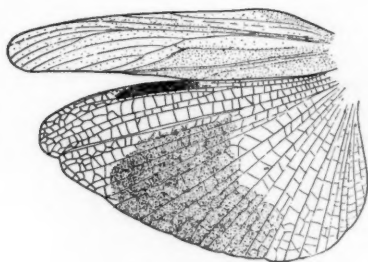
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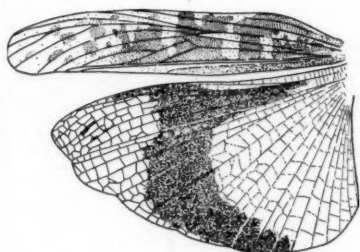
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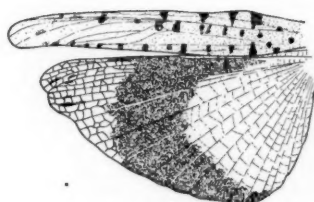
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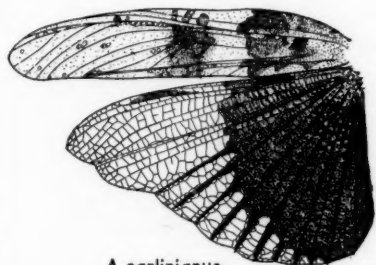
C. viridifasciata 64



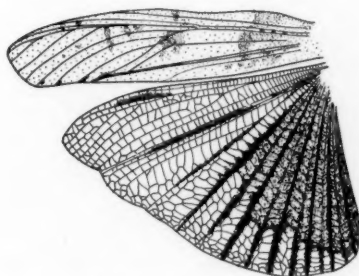
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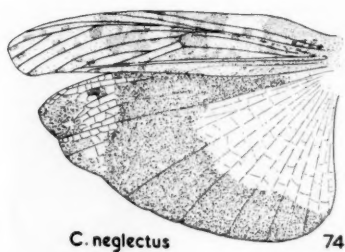
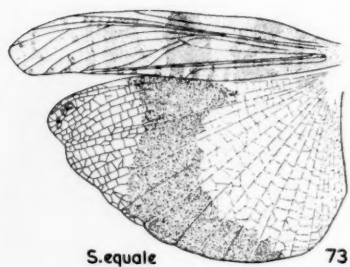
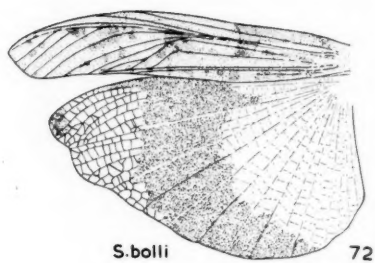
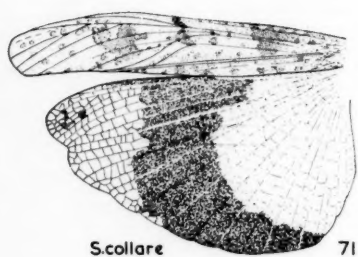
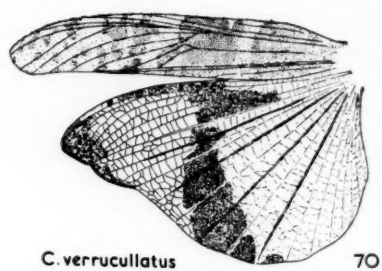
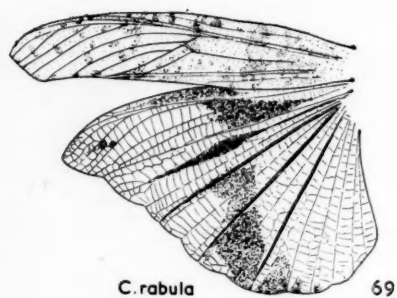


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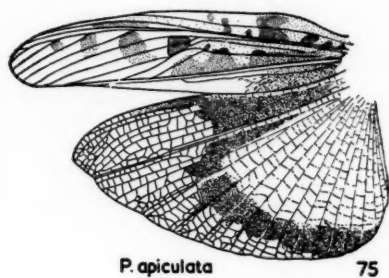


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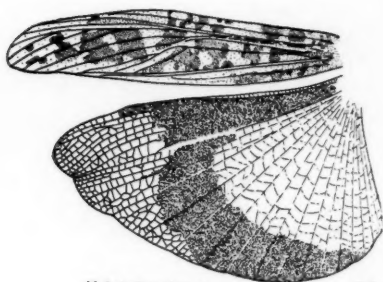
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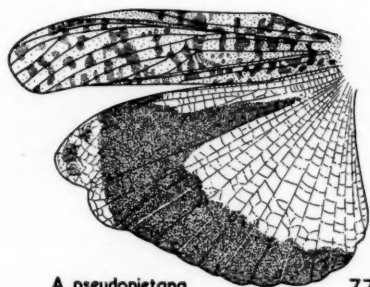
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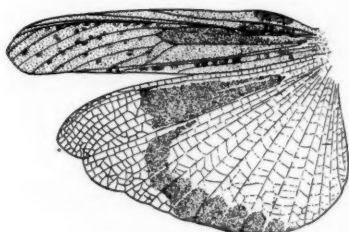
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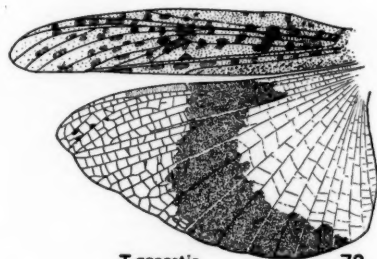
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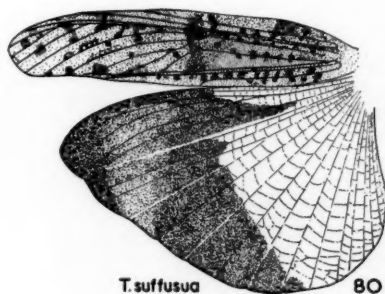
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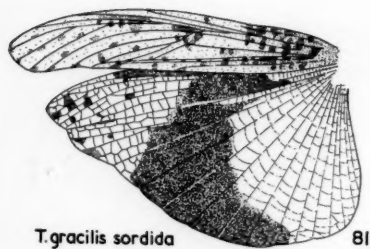
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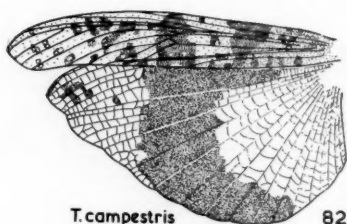
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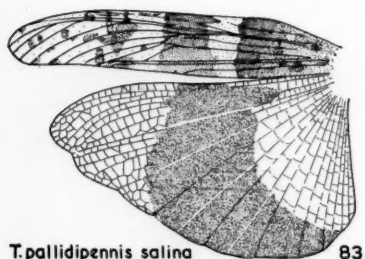
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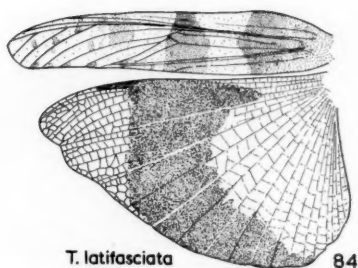
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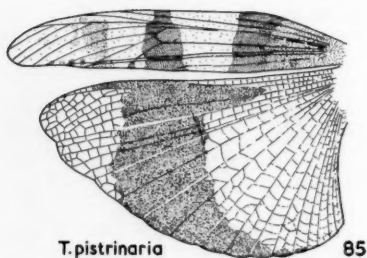
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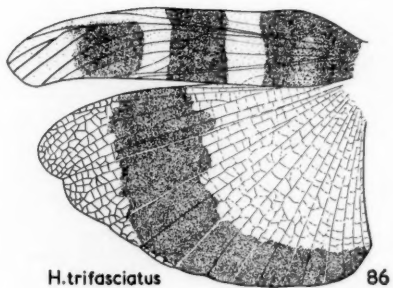
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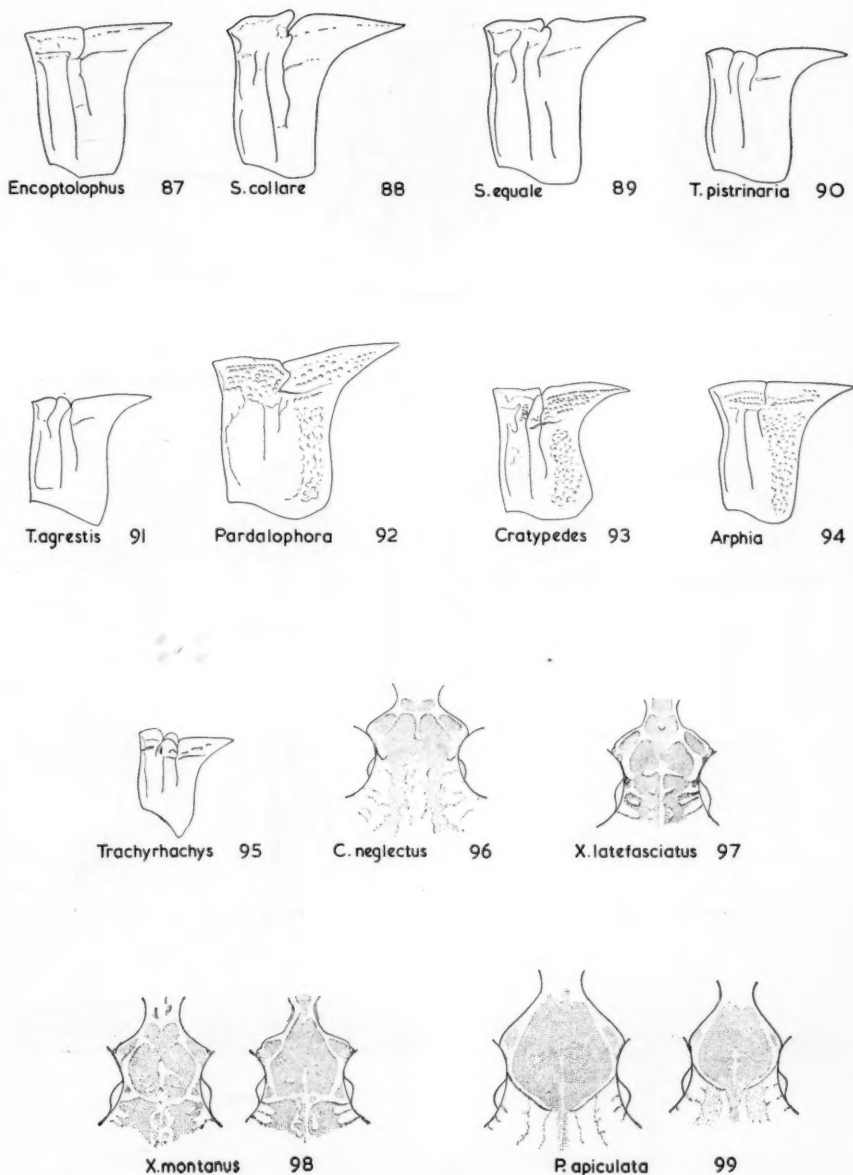
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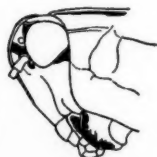
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*T. ornata*

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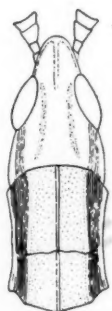
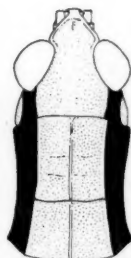
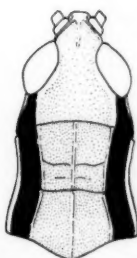
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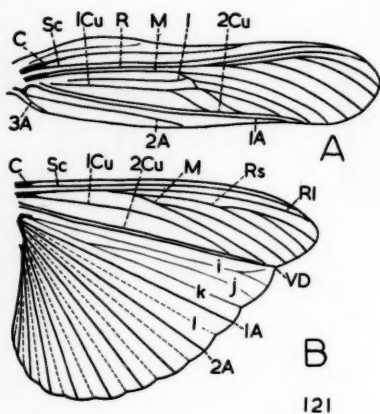
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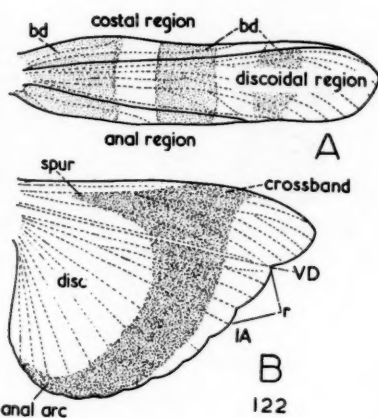
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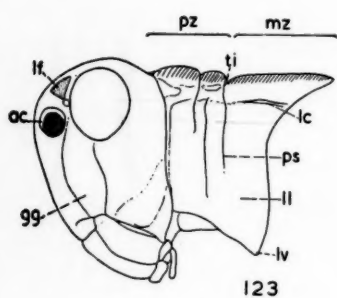
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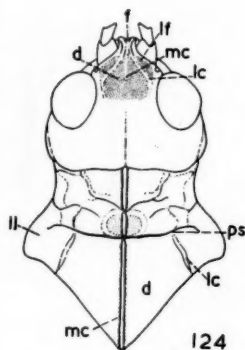
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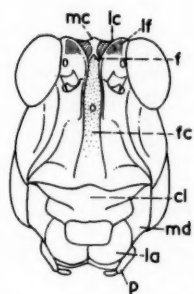
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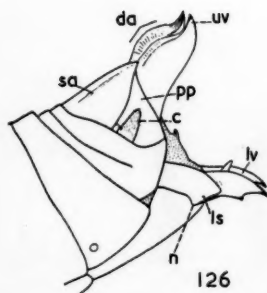
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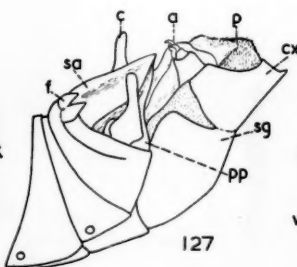
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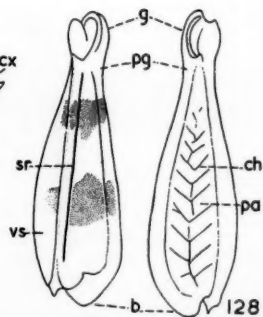
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Figs. 123-125. Lateral, dorsal, and anterior view of a grasshopper head and pronotum. ac, antennal crescent; cl, clypeus; d, disc of vertex or of pronotum; f, fastigium; fc, frontal costa; gg, genal groove; la, labrum; lc, lateral carina of head or of pronotum; lf, lateral foveolae; ll, lateral lobe of pronotum; lv, latero-ventral angle of pronotum; mc, median carina of head or of pronotum; md, mandible; mz, metaxona; p, palp; ps, principal sulcus; pz, prozona; ti, incision of principal sulcus.

Figs. 126, 127. Female and male genital segments of a grasshopper. a, aedeagus; c, cercus; cx, coxale or terminal portion of the subgenital plate; da, dorsal angle of upper valve; f, furcula; n, notch or emargination of the eighth sternite; ls, lateral basivalvular sclerite; lv, lower valve of ovipositor; p, pallium; pp, podical plate or paraproct; sa, supra-anal plate; sg, subgenital plate.

Fig. 128. Hind femur of a grasshopper. ch, chevron; b, base; g, genicular portion; pg, pregenicular portion; pa, pagina; sr, stridulating ridge; vs, ventral sulcus.

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